From Research to Thesis: Principles of Scientific Writing and Argumentation

Version 2.0

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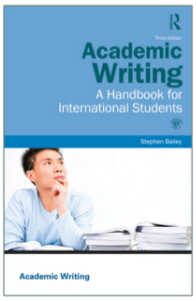
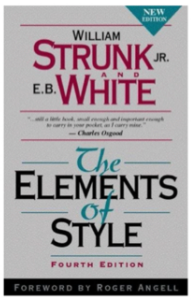
Disclaimer This document contains information and recommendations exclusively for students writing their BSc or MSc thesis in the Pattern Recognition Group. Consequently, the guidelines and conventions described here do not necessarily apply to theses written in other research groups or disciplines.

References The content of these notes is largely based on the following two books, which provide a comprehensive and complementary perspective on academic writing.

- Bailey, Stephen. *Academic Writing: A Handbook for International Students*. Routledge, 2014.
- Strunk, William, and E. B. White. *The Elements of Style*. SWB Books, 1918.





We strongly recommend consulting both books in parallel. Together, they offer a broader and deeper foundation for academic writing, including additional explanations, examples, exercises, and stylistic guidance that go beyond the scope of these notes.

Writing Reflects Scientific Thinking Scientific writing is not a cosmetic activity that merely follows after research is completed. Rather, it is an integral part of scientific thinking itself. How a problem is described, how results are reported, and how conclusions are justified directly reflects the clarity, rigor, and validity of the underlying reasoning. Unclear writing is therefore not only a stylistic issue, but often an indicator of unclear or incomplete scientific thought.

Scope and Intended Use The purpose of this document is not merely to provide linguistic rules or stylistic recommendations. Its primary goal is to teach how to reason, argue, and communicate like a scientist. The guidelines presented here are therefore designed to support scientific thinking, not just to improve phrasing or formal correctness. These notes are intended as a practical guideline to support students during the thesis writing process. They are not meant to replace supervision, feedback, or established scientific standards within the field.

Contents

Chapter 1

Purpose and Elements of Academic Writing

1.1 Purpose of Academic Writing

Writers of academic texts should be clear about *why* they are writing. Academic writing always serves a specific communicative purpose and is directed at a clearly defined audience. Among the most common reasons for writing in an academic context are the following:

- to report on a piece of research that the writer has conducted (e.g., a BSc or MSc thesis)
- to answer a research question that the writer has been assigned or has chosen to address
- to discuss a topic of general scientific interest and to develop a reasoned position
- to summarize, structure, and critically assess research conducted by others on a topic

In all cases, it is essential to keep the intended readership in mind. In the context of a thesis in computer science, we typically assume an interested reader with a background at the master's level. The text should therefore be written for a knowledgeable, but not omniscient, audience.

When writing, you should continuously reflect on the following questions:

- How can the underlying ideas be explained clearly and precisely?

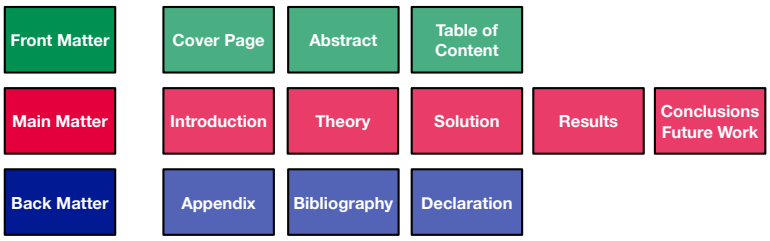


Figure 1.1: The key elements of a thesis grouped into front, main, and back matter.

- Which level of prior knowledge can reasonably be assumed?
- Which established concepts or modes of reasoning can be relied upon?
- At which points might the reader benefit from a brief reminder or clarification?
- Where would an example, illustration, or intuition support understanding?

Although there is no single fixed standard of academic writing, it is clearly distinct from the style used in newspapers, essays, or novels. Academic writing follows a set of widely accepted conventions that aim to ensure clarity, precision, and verifiability. Academic writing ...

- ... is accurate, precise, and objective.
- ... uses formal and discipline-appropriate vocabulary.
- ... avoids idiomatic or colloquial expressions.
- ... predominantly employs an impersonal style.
- ... incorporates formal elements such as equations, definitions, proofs, and algorithms where appropriate.
- ... relies on citations and includes a complete list of references.
- ... makes conscious and consistent use of both passive and active voice.

1.2 Elements of Academic Writing

Most BSc and MSc theses consist of a set of well-established structural elements (see also Fig. 1.1). These elements serve different purposes and together form a coherent and readable document.

- Front Matter

  - Cover Page (with Title)
  - Abstract
  - Table of Contents
- Main Matter (five or six chapters of the thesis[1])
  - Introduction
  - Theory (sometimes subdivided into *Background* and *Related Work*)
  - Solution
  - Results
  - Conclusion
- Back Matter
  - Appendix
  - Bibliography
  - Declaration of Authorship

In the following subsections, these elements are described in greater detail, with a focus on their purpose, structure, and typical content in the context of a BSc or MSc thesis.

1.2.1 Front Matter

Cover Page The cover page contains the most important information about the institution, the author, and the written work, such that all relevant details can be grasped at a glance (→ use the templates).

Probably the most important decision made on the cover page is the title of the thesis. In some cases, the title is predefined in the project proposal; however, such titles are usually provisional. You are therefore free, and encouraged, to choose a more suitable and precise title for the final thesis.

- The title should clearly indicate the content of the thesis.
- The title (in normal font) should not exceed one line.
- The title may be complemented by a subtitle.

[1] Note that these are generic chapter titles. You should use more descriptive and content-specific titles in your own work.

- The title itself should be concise and attract the reader's interest.
- The subtitle should provide additional information about the scope, method, or direction of the work.
- The subtitle must not repeat information already contained in the title.

Abstract The abstract provides a concise summary of the thesis and gives an overview of its main points. It must be precisely worded and self-contained. Do not cite any sources in the abstract. The abstract should be understandable without prior knowledge of the topic. Its length is typically between 150 and 300 words and must not exceed one page. The abstract should be written at the very end of the thesis writing process.

Abstract vs. Introduction

Students often find it difficult to distinguish between the abstract and the introduction. The key difference lies in their *purpose*:

- *Purpose of an introduction*: To introduce the topic, define the goals, and outline the structure of the thesis.
- *Purpose of an abstract*: To summarize the entire project, in particular its results and scientific contribution.

A useful rule of thumb is that the abstract answers the question *"What has been done and what was found?"*, whereas the introduction explains *"Why this topic is relevant and how the thesis is organized."*

Usually, an abstract addresses the following six aspects:

1. The context and background of the research (both general and specific)
   - What is already known? What is the thesis about?
2. The relevance of the topic
   - Why is the topic important? Does the work address a new problem, close a gap in existing research, apply new methods to existing data, or resolve an open issue?
3. The central research question(s) and major goal(s)
   - What are the objectives of the project?
4. The research methods and overall approach
   - How is the problem addressed?

5. The key findings and most important results
    - What is found?
6. The significance and main conclusions
    - Why are the findings important?

Table of Contents The table of contents reflects the structure of the thesis and provides a first impression of its content and overall quality. It allows the reader to assess whether topics are balanced and whether section titles are consistent. Moreover, it enables a quick structural check, for example whether each section is divided into at least two subsections (e.g., Section 2.1 must be followed by Section 2.2).

Rule of Structural Consistency

A subsection is only meaningful if it is followed by at least one further subsection on the same level. For example, if a chapter contains Sections 2.1 and 2.2, this structure is valid. However, introducing Section 2.2.1 without a corresponding Section 2.2.2 is structurally incorrect and should be avoided.
In practice, this means that any sectioning level (sections, subsections, or subsubsections) must consist of at least two elements. If a topic does not warrant further subdivision, the additional level should be omitted entirely.
This rule also enables a quick structural sanity check: for instance, Section 2.1 must always be followed by Section 2.2, and a subsection such as Section 2.2.1 must be followed by Section 2.2.2.

The hierarchy of sections should be limited to a maximum of three levels. Thus, Chapter 2 may be divided into Sections 2.1, 2.2, 2.3, ..., and each section into Subsections 2.x.1 and 2.x.2. The final level of division, *subsubsections* (level 2.x.x), is not numbered in the provided templates and is therefore not listed in the table of contents. However, the bibliography and appendix must be listed in the table of contents with page numbers (→ use the templates).

1.2.2 Main Matter

Introduction The final version of the introduction is written *after* the remaining chapters of the thesis have been completed. However, *before* writing the main body, it is strongly recommended to sketch the content of the introduction in bullet points. This helps to clarify the scope, objectives, and narrative of the thesis from the outset. If it is clear which aspects are covered in the introduction, it becomes easier to decide whether a concept must be introduced or explained in later chapters and to what level of detail. It is perfectly acceptable to introduce a concept informally in the introduction and to formalize and elaborate on it in subsequent chapters.

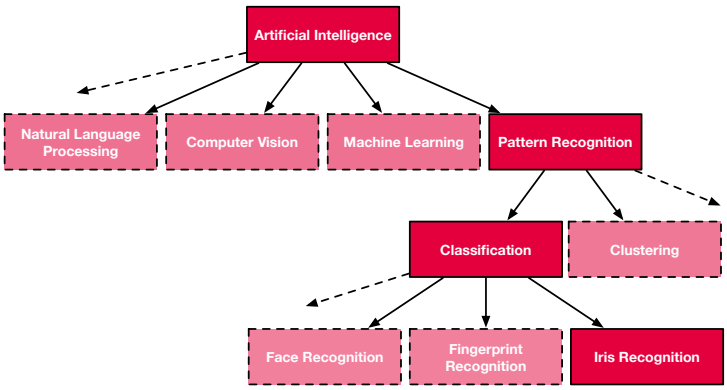


Figure 1.2: The topic *Iris Recognition* is placed in larger context in a top-down manner.

As a guideline, the introduction should comprise approximately 10% of the total thesis length. For a 30-page thesis, this corresponds to about 3–4 pages.

In contrast to the abstract, the introduction is *not* a summary of results. Instead, it provides context, motivation, and orientation, and should encourage the reader to continue reading.

A well-structured introduction addresses the following aspects:

- What is the *topic* and its broader *context*?
- What are the *goals* and *research questions*?
- How is the thesis *organized*?

Accordingly, a typical introduction consists of three parts:

- *Topic and Context*: At the beginning of the introduction, the topic should be embedded into a broader context using a top-down approach.

  For example, if the thesis addresses *Iris Recognition* (see Fig. 1.2), one may start by placing the work in the field of Artificial Intelligence (AI). The introduction then narrows down to Pattern Recognition (PR) as a subfield of AI, followed by a discussion of classification and clustering. Since iris recognition is a classification task, the introduction can then outline related classification problems before arriving at the specific topic of the thesis.

  In addition, the introduction should make explicit which gap in existing research the thesis addresses. From this research gap, the central research question and the main goal of the thesis can be directly inferred.

Research Gap

A *research gap* refers to a clearly identifiable limitation, open question, or missing aspect in the existing body of research. Such a gap is typically identified through the analysis of related work and provides the scientific motivation for a new study.
A research gap may arise, for example, from:

- methodological limitations of existing approaches,
- missing or insufficient empirical evaluations or comparisons,
- unexplored problem settings or application domains,
- contradictory or inconclusive findings in the literature.

A strong scientific thesis makes the research gap explicit and demonstrates how the presented work contributes to closing or better understanding this gap.

- *Goal(s)*: The introduction must clearly state the central research question and the main objective of the thesis. This includes a concise motivation, an explanation of the scientific relevance of the problem, and – where applicable – the formulation of one or more research hypotheses[2].

Goal vs. Method

Students often confuse the *goal* of a thesis with the *method* used to achieve it. These two aspects serve different purposes and should be clearly distinguished.

- *Goal*: Describes **what** the thesis aims to achieve. It is derived from the identified research gap and defines the intended outcome or contribution of the work.
- *Method*: Describes **how** the goal is pursued. It includes the chosen approaches, algorithms, models, datasets, and experimental procedures.

A well-written introduction states the goal independently of the method. The method is then introduced as a means to achieve this goal, not as a goal in itself.

Optional goals may be defined during early project discussions. Such goals should only be mentioned in the final thesis if they have actually been achieved and must then not be labeled as optional.

Some scientific theses explicitly state their main contributions. A *contribution statement* briefly summarizes what is new and what scientific or practical value the work provides.

[2] A *research question* formulates the central problem the thesis seeks to address. A *hypothesis* is a concrete, testable assumption derived from this question and from existing research. Hypotheses are typically formulated in empirical theses and are evaluated based on experimental results. Not all theses require explicit hypotheses; however, when empirical methods are used, clearly stated hypotheses help to structure the evaluation and interpretation of results.

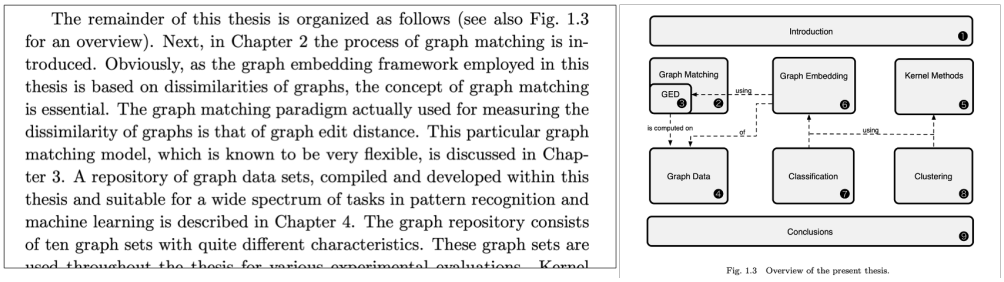


Figure 1.3: An outline of a thesis (in text form and graphically).

Typical contributions include:

- a novel algorithm or method,
- a systematic comparison or evaluation,
- a new application of existing techniques,
- an improved analysis or experimental setup.

A clear contribution statement helps readers quickly understand the added value of the thesis.

- *Outline*: Finally, the introduction should briefly describe the structure of the thesis, explaining which topics are addressed in which chapters and how the argument develops (see Fig. 1.3).

Theory, Solution, Results After the introduction, the core of the thesis follows. This part typically accounts for about 80% of the total length (e.g., roughly 24 pages in a 30-page thesis). Its structure depends on the research question, the chosen methodology, and the topic.

In our research group, many theses are empirical and focus on the development and evaluation of a novel method or algorithm applied to specific data. The main body is therefore often divided into three chapters[3]:

- *Theory*: This chapter embeds the research question in its theoretical context and presents the relevant state of the art and reviews related work. This includes existing approaches, methods, and results that are directly relevant to the research question. The goal is not only to summarize prior work, but also to critically compare it and to highlight limitations, open issues and research

[3]Note that *Theory*, *Solution*, and *Results* are generic chapter titles and should be replaced by more descriptive ones.

gaps that motivate the present thesis.

We recommend following the same general structure as in the introduction, but at a much greater level of detail. Rephrase earlier explanations and avoid copying text from the introduction.

The central research questions and goals are specified formally, and the existing scientific knowledge on the topic is reviewed. The theoretical discussion also serves as the basis for deriving hypotheses.

- Which theories and models are relevant to the research question?
- Which hypotheses can be derived for the empirical investigation?

The appropriate level of detail depends on the importance of a concept for the thesis. Core concepts must be introduced formally and explained thoroughly. Concepts that are merely used as tools may be described briefly. However, if specific parameters or design choices have a significant impact on the results, these must be explained in sufficient detail.

Background vs. Related Work

The theoretical part of a thesis typically serves two closely related but distinct purposes: introducing necessary background and discussing related work.

- *Background* provides the concepts, models, and methods required to understand the thesis.
- *Related Work* critically reviews existing approaches, methods, and results from the literature and compares them with the present work.

In many theses, both aspects are combined within the same chapter. However, in more extensive theses or when the amount of related work is substantial, it can be clearer and more readable to separate them into two chapters (e.g., *Background* and *Related Work*).
What matters in either case is that it becomes clear what is already known, which approaches exist, and how the present work differs from or builds upon them.

- *Solution*: Based on the discussion of related work and identified research gaps, this chapter describes the developed method and its implementation in detail. It typically includes algorithms, the overall framework, data sources, and data structures.

Algorithms and procedures should be presented using the LaTeX packages `algorithm` and `algorithmic` ($\rightarrow$ use the templates). Every displayed algorithm must be explained in the surrounding text, including the purpose of its

individual steps.

Source code (e.g., in Python or Java) should be shown using the LaTeX package `minted` (→ use the templates). Do *not* include screenshots. Only include code fragments if they serve a clear explanatory purpose and describe their key aspects precisely. As a rule of thumb, include as little code as possible, but as much as necessary to convey the programming effort and design decisions. More extensive code excerpts may be placed in the appendix if required.

- *Results*: This chapter presents and critically discusses the empirical results. Where appropriate, the findings are related back to the theoretical context and the research questions introduced earlier.

  In particular, the chapter addresses the following aspects:

  - How is the experimental setup defined, including data, parameters, and evaluation protocol?
  - What are the main results of the empirical investigation?
  - Can the hypotheses be confirmed, or must they be revised?
  - How do the results compare to existing research and baseline approaches?
  - What are the strengths and weaknesses of the chosen experimental design and method?
  - Which quality criteria (e.g., validity, robustness, reproducibility) are satisfied by the results?
  - What are the main conclusions and key takeaways that can be drawn from the experiments?

  Clear description and careful reporting of results are crucial for a successful thesis. For this reason, Chapter 4 explains the key elements of describing and reporting empirical results in detail.

Negative Results

Not all scientific investigations lead to positive or expected results. Negative or inconclusive results can still constitute a valuable scientific contribution if they are obtained through sound methodology and are critically discussed. The scientific value of a thesis lies not in the success of a method, but in the clarity, rigor, and transparency with which the results are obtained and interpreted.

Conclusion and Future Work The conclusion rounds off the thesis and, together with the introduction, forms its conceptual framework. It revisits the research questions and places the findings into a broader context. The conclusion should differ in content from the abstract and is typically more detailed. Approximately 10% of the total thesis length is devoted to this section.

- The central questions are revisited and discussed.
- The developed method is summarized.
- The main results are restated and critically assessed.
- The significance of the findings is evaluated.

In addition, open questions and directions for future research should be outlined. Possible aspects of future work include:

- Whether the main research question has been fully answered.
- Whether the developed solution is convincing.
- Existing shortcomings or limitations.
- Remaining ambiguities.
- Possible extensions or improvements.
- Missing results or open problems.

1.2.3 Back Matter

Appendix In the main body of the thesis, only selected highlights of the code or representative figures should be presented to support the central findings. Supplementary material is then referenced and provided in the appendix for the sake of completeness. An appendix, which appears after the conclusion, includes, for example, source code of the developed solution, complete sets of figures or tables, or proofs that are referenced in the thesis.

Bibliography A detailed description of the organization and structure of the bibliography is given in Chapter 3.

Erklärung

gemäss Art. 30 RSL Phil.-nat.18

Name/Vorname:

Matrikelnummer:

Studiengang:

Bachelor ☑ Master ☐ Dissertation ☐

Titel der Arbeit:

LeiterIn der Arbeit:

Ich erkläre hiermit, dass ich diese Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen benutzt habe. Alle Stellen, die wörtlich oder sinngemäss aus Quellen entnommen wurden, habe ich als solche gekennzeichnet. Mir ist bekannt, dass andernfalls der Senat gemäss Artikel 36 Absatz 1 Buchstabe r des Gesetzes vom 5. September 1996 über die Universität zum Entzug des auf Grund dieser Arbeit verliehenen Titels berechtigt ist.
Für die Zwecke der Begutachtung und der Überprüfung der Einhaltung der Selbständigkeitserklärung bzw. der Reglemente betreffend Plagiate erteile ich der Universität Bern das Recht, die dazu erforderlichen Personendaten zu bearbeiten und Nutzungshandlungen vorzunehmen, insbesondere die schriftliche Arbeit zu vervielfältigen und dauerhaft in einer Datenbank zu speichern sowie diese zur Überprüfung von Arbeiten Dritter zu verwenden oder hierzu zur Verfügung zu stellen.

Ort/Datum

Unterschrift

Figure 1.4: Declaration that you have independently written the thesis.

Declaration of Authorship The thesis must include a signed declaration of authorship[4] ("Erklärung" – see Fig. 1.4), in which the candidate confirms that the work was authored independently. Print, sign, scan, and include the declaration at the very end of the thesis.

Process Recommendation: Plan First, Write Second

A common mistake in thesis writing is to start drafting text before the overall structure and argument are clear. This often leads to redundancies, weak transitions, and an unclear line of reasoning.
Writing immediately typically results in:

- locally well-written paragraphs without a coherent global structure,
- unclear separation of introduction, theory, results, and discussion,
- frequent restructuring late in the writing process.

Planning first leads to:

- a clear and coherent line of argument from the research question to the conclusion,
- well-balanced chapters with clear roles and responsibilities,
- more focused writing and fewer structural revisions.

For this reason, it is strongly recommended to first design a complete structural skeleton of the thesis (chapters, sections, and key bullet points) and discuss it with the supervisor *before* writing continuous text. Writing should then be understood as filling an already well-defined structure with precise and well-argued content.

[4] `https://www.philnat.unibe.ch/studium/formulare/index_ger.html`

Checklist: Purpose, Structure, and Elements of a Thesis

Before proceeding to the main writing phase, make sure that the following points are clear and fulfilled:

- The purpose of the thesis is clearly defined (e.g., answering a research question, developing a method, or analysing results).
- The intended readership and assumed background knowledge are clear and appropriate.
- The research context is introduced top-down, from the broader field to the specific topic.
- The research gap addressed by the thesis is explicitly identified.
- The main objective of the thesis is logically derived from the identified research gap.
- The central research question(s) are clearly formulated.
- Where applicable, research hypotheses are stated explicitly and unambiguously.
- The contribution of the thesis is clearly distinguished from existing work.
- The overall structure of the thesis is logically organized and explained in the introduction.
- The roles of introduction, theory, solution, results, and conclusion are clearly separated.
- The abstract provides a concise, self-contained summary of the entire thesis, including results and contributions.
- The introduction motivates the topic without anticipating results.
- Front matter, main matter, and back matter are complete and correctly planned.
- A complete structural skeleton of the thesis is prepared *before* writing:
  - chapters, sections, and subsections are defined,
  - section titles are meaningful and content-specific,
  - the intended content of each section is sketched using bullet points.
- The prepared thesis skeleton is discussed with the supervisor to verify coherence, balance, and logical flow.
- The overall structure supports a clear line of argumentation from motivation to conclusion.

If all points above can be answered confidently, the conceptual and structural foundation of the thesis is well prepared.

Chapter 2

Language and Structure

2.1 Language

When writing a BSc or MSc thesis, it is essential to follow the rules of grammar, including seemingly minor conventions such as capitalization and punctuation[1]. Deviating from expected rules draws the reader's attention, and the reader's attention is a valuable resource that should not be wasted. In academic writing, the focus should be on the ideas being conveyed, not on the writing itself.

Scientific texts therefore require a formal and objective style. While there is no single set of rules that applies to all academic writing situations, the following guidelines can help you develop a clear and appropriate academic style.

Formality vs. Complexity

Formal academic language does not mean complex or unnecessarily difficult language. Clarity and precision are more important than sophisticated vocabulary or long sentences. A well-written scientific text expresses complex ideas as clearly and simply as possible. If a sentence can be shortened or simplified without loss of meaning, it usually should be.

2.1.1 What to Avoid

When writing, make sure to avoid the following issues (please carefully check your thesis before submission).

- Trivial spelling mistakes (e.g., The *resutls* show ...)
- Subjective exaggerations (e.g., The results show how *perfectly* the new system works.)

[1] As a starting point for further reading, we suggest the classical book by Strunk and White, *The Elements of Style*, mentioned in Chapter 0 of these notes.

- Meaning-enhancing or subjective terms (e.g., The *many* tests *naturally* led to *very* different results.)
- Casual or emotional evaluations (e.g., *Unfortunately*, this approach proved to be *completely pointless*.)
- Expressions of personal enthusiasm (e.g., This statement can be *wholeheartedly* agreed with *from the author's point of view*.)
- Adverbs expressing personal attitude (e.g., *luckily*, *remarkably*, *surprisingly*, etc.)
- Personal phrases (e.g., *in my opinion* or *personally, I think* ...)

Avoiding First-Person Narration

In academic writing, especially in theses, structural and methodological decisions should not be presented as personal actions of the author (e.g., *"In order to ..., I subdivide ..."* or *"Consequently, I set ..."*). Such formulations foreground the author rather than the scientific reasoning and may give the impression of arbitrariness.
Instead, focus on the logic, necessity, or rationale behind the decision. This can be achieved by using impersonal constructions, passive voice, or subject–action formulations that emphasize the method or structure itself.
Typical alternatives include:

- Impersonal constructions: *"To address this issue, the chapter is subdivided into ..."*
- Passive voice: *"The parameters are selected based on ..."*
- Subject–action focus: *"This section introduces ..."*, *"The approach is structured as follows ..."*

The goal is not to eliminate agency, but to shift attention from the author to the scientific argument. Good academic style makes decisions appear necessary, motivated, and reproducible – rather than personal.

- Colloquialisms and platitudes (e.g., *So it came as it had to come* – the algorithm didn't work.)
- Idiomatic or colloquial vocabulary
  - *like* (use *for instance* or *for example*)
  - *lots of* (use *a significant/considerable number* or *numerous*)
  - *little/big* (use *small/large*)
  - *get better/worse* (use *improve/deteriorate*)
  - *good/bad* (use *positive/negative*)

- Filler expressions (e.g., Although there *apparently* are proponents of this view, it is not accurate*, so to speak.*)
- Question forms (e.g., *Why does this algorithm not work?*)
- Contracted verb forms (e.g., *don't*, *can't*)
- Absolute statements (e.g., *Using x always leads to better results.*)

Neutral Tone vs. Scientific Evaluation

Avoiding subjective language does not mean avoiding evaluation. Scientific writing requires critical assessment, but this assessment must be based on evidence, not personal opinion or emotional wording. Instead of expressing approval or disappointment, evaluations should be grounded in data, comparisons, and clearly stated criteria.

Another aspect that must be strictly avoided is reflective writing. A BSc or MSc thesis should *never* read like a work log or travelogue. Even if many attempted approaches did not lead to success during the research process, the thesis should be written as if the final approach had been planned from the beginning. In this sense, the author adopts the role of an *omniscient* writer. The structure of a thesis is therefore rarely – if ever – a reflection of the chronological order of the underlying research activities.

This does not mean that negative results must be concealed. Reporting negative results can be scientifically valuable, provided they are presented in a structured manner. For example, such results may be discussed in the context of preliminary experiments, followed by an explanation of the insights gained and the adjustments that ultimately led to improved outcomes.

Writing About Negative Results

When reporting negative results, the focus should be on insight and understanding, not on justification or apology (they contribute to scientific progress by delineating boundaries, assumptions, and limitations.). *Avoid defensive or emotional language* such as:

- "Unfortunately, the method failed to achieve satisfactory results."
- "Despite many attempts, the approach did not work as expected."

Prefer neutral, analytical formulations that emphasize observation and explanation:

- "The proposed method does not outperform the baseline under the tested conditions."
- "These findings suggest that the underlying assumption does not hold for this dataset."

Link negative outcomes to insight by highlighting what was learned:

- "This result reveals a limitation of the method in highly imbalanced settings."
- "These observations motivate alternative modeling choices discussed in the following section."

Finally, avoid uncontrolled redundancy. Repeating ideas or including irrelevant points suggests that the author is not fully in command of the material. It may give the impression that the language is not properly mastered or that the text is being artificially extended by repetition.

In some cases, however, redundancy is intentional and even useful. A concept that is introduced informally (e.g., in the introduction) may later be revisited and explained in greater detail. In such situations, it is crucial not to reuse identical sentences or paragraphs without modification[2].

2.1.2 Academic Vocabulary

When writing, you should strive for clarity, conciseness, and stringency. Simple vocabulary and simple sentence structures are often particularly effective, as they enhance clarity. That is, avoid long, convoluted, or warped phrases that twist, turn, and distract from the main point. In particular, do not use long sentences with complex grammar and unusual words merely to demonstrate linguistic ability.

There is also rarely a good reason to use synonyms for the same concept. Choose a terminology and use it consistently throughout the thesis.

Terminology Consistency

In scientific writing, consistency in terminology is essential. Once a term, notation, or convention has been chosen, it should be used consistently throughout the entire thesis. Introducing unnecessary synonyms or switching between terms for the same concept increases cognitive load and may confuse the reader. Consistency applies not only to technical terms, but also to spelling conventions (e.g., *dataset* vs. *data set* vs. *data-set*), notation ($\mathbf{x}$ vs. x vs. $\mathtt{x}$), and abbreviations (Fig. vs. Figure).
In summary: In academic writing, precision is usually more important than stylistic variation. Repeating the same term for the same concept is not a weakness, but a strength. Using different words for the same concept may suggest subtle differences in meaning where none are intended. Consistent terminology helps the reader follow complex arguments without unnecessary cognitive effort.

To write academic texts, you need to be familiar with the rather formal vocabulary commonly used in this domain. Students wishing to develop their academic vocabulary are encouraged to study the *Academic Word List* (AWL). While you may try to learn words from the list on a daily basis, it is often more effective to study them in context, in order to understand how they are actually used.

[2] We typically read a thesis in one continuous pass. Encountering the same sentence or paragraph twice creates a negative impression – and negative impressions tend to result in poor grades.

The AWL was developed by Averil Coxhead at Victoria University of Wellington, New Zealand[3]. The list contains 570 word families, which were selected according to specific principles. These selection principles are:

1. Range: The AWL families occur across the Arts, Commerce, Law, and Science faculties in the underlying academic corpus.
2. Frequency: The AWL families occur more than 100 times in the 3,500,000-word academic corpus.
3. Uniformity of frequency: The AWL families occur at least 10 times in each faculty-specific subcorpus.

Four examples of the 570 word families are shown below (see `awlsublists.pdf` on ILIAS for the complete list)[4].

- **analyse**: analysed; analyser; analysers; analyses; analysing; *analysis*; analyst; analysts; analytic; analytical; analytically; analyze; analyzed; analyzes; analyzing
- ***context***: context; contexts; contextual; contextualise; contextualised; contextualising; uncontextualised; contextualize; contextualized; contextualizing; uncontextualized
- **evident**: evidenced; *evidence*; evidential; evidently
- **vary**: invariable; invariably; variability; variable; *variables*; variably; variance; variant; variants; variation; variations; varied; varies; varying

The complete word list is divided into ten sublists based on word frequency within the academic corpus. Each sublist contains 60 word families, except for sublist 10, which consists of 30 families ($9 \times 60 + 30 = 570$ word families in total).

Words from sublist 1 occur more frequently in academic texts than those from later sublists. Sublist 2 contains the next most frequent words, and so on. On average, a word from a sublist 1 family appears approximately once every four pages of an academic text. In contrast, words from sublist 10 appear only about once every eighty-two pages (assuming roughly 400 running words per page; these values are averages).

[3] `https://www.wgtn.ac.nz/lals/resources/academicwordlist/information`

[4] Each word printed in italics is the most frequently occurring member of the corresponding word family.

The following table shows the most frequently occurring member of each of the 60 most frequent word families (i.e., sublist 1):

analysis	definition	indicate	procedure
approach	derived	individual	process
area	distribution	interpretation	required
assessment	economic	involved	research
assume	environment	issues	response
authority	established	labour	role
available	estimate	legal	section
benefit	evidence	legislation	sector
concept	export	major	significant
consistent	factors	method	similar
constitutional	financial	occur	source
context	formula	percent	specific
contract	function	period	structure
create	identified	policy	theory
data	income	principle	variables

2.1.3 Using Verbs and Tenses

Academic writing tends to use rather formal verbs in order to express meaning accurately and precisely. The following list contains formal verbs that are frequently used in academic texts.

Accelerate	Access	Achieve	Adapt	Affect	Aid	Allocate
Alternate	Analyze	Approach	Argue	Arise	Assess	Assign
Assist	Assume	Attain	Attribute	Be concerned	Categorize	Channel
Characterize	Claim	Clarify	Classify	Commit	Communicate	Compensate
Compound	Comprehend	Comprise	Concentrate on	Conclude	Conduct	Confirm
Consent	Confine	Constrain	Consume	Contract	Contradict	Contrast
Contribute	Convert	Coordinate	Create	Decline	Deduct	Define
Demonstrate	Derive	Detect	Determine	Deviate	Deteriorate	Diminish
Discriminate	Document	Emphasize	Enforce	Envisage	Emerge	Establish
Estimate	Evaluate	Exhibit	Expand	Facilitate	Focus	Function
Fund	Generate	Grant	Guide	Hold	Identify	Illustrate
Implement	Improve	Imply	Impose	Inhibit	Insert	Indicate
Integrate	Interact	Interpret	Intervene	Invest	Involve	Isolate
Justify	Legislate	Link	Locate	Maintain	Manifest	Modify
Monitor	Obtain	Occupy	Occur	Overcome	Participate	Perceive
Precede	Prioritize	Process	Promote	Propose	Prove	Publish
Pursue	React	Recognize	Refine	Regulate	Reinforce	Relate
Rely	Remove	Respond	Restore	Restrict	Retain	Reverse
Seek	Select	Specify	State	Submit	Supplement	Survey
Transfer	Undergo	Validate	Yield			

Verb Choice and Strength of Claim

Different verbs imply different levels of certainty and strength of claim. Choosing an inappropriate verb may unintentionally overstate or understate a result.

For example, *suggest* is weaker than *indicate*, which is weaker than *demonstrate*. The verb *prove* should be used with particular care and is often inappropriate for empirical results. Verb choice should accurately reflect what the data or analysis supports.

A *phrasal verb* is a verb composed of two or more words, typically a main verb combined with an adverb or a preposition (or both). The resulting meaning often differs from that of the individual words, which makes phrasal verbs difficult to interpret, especially for non-native English speakers.

Some phrasal verbs are too informal for academic writing. The following table lists a few examples of such unsuitable phrasal verbs together with more appropriate alternatives.

Phrasal Verb	**Better Solution**
Get up	Rise or increase
Put into	Contribute
Find out	Discover
Look at	Explore / Research
Look into	Examine
Look out for	Identify
Look up	Verify
Got together	Merge
Bring about	Cause
Cut out	Delete
Come across	Find

However, some phrasal verbs are acceptable and commonly used in academic writing. We recommend, for instance, the following expressions:

- *carry out*
- *consists of*
- *discussed by*
- *based on*

A frequently discussed and sometimes controversial question concerns the choice of tense in a BSc or MSc thesis. The most important principle is to maintain consistency in the use of tenses throughout the text. In computer science, it is common practice to write predominantly in the present tense. Although this may initially seem counterintuitive, it simplifies writing and is widely accepted in the field.

Even when referring to papers published many years (or decades) ago, the present tense is often appropriate, as the results are still considered valid or accessible:

- Brown et al. [17] *show / prove / validate* in their paper ...

The same principle applies to descriptions of one's own methods, experiments, figures, and results:

- The research findings *demonstrate* that ...
- The experiments empirically *prove* ...
- The experiment *yields* ...
- This chapter first *describes* ..., then *explains* ...
- Algorithm 17 *uses* ...
- Fig. 17 *shows* ...

Only when discussing aspects of future work does it typically make sense to change the tense. Even in such cases, this can often be handled using modal verbs or specific verb phrases that express possibility or intention, such as *could be*, *might be*, *aim to*, or *plan to*.

- More advanced methods *could be* investigated.
- A combination *might be* beneficial.
- We *aim to* combine the two methods.
- We *plan to* conduct more exhaustive evaluations.

Present Tense and Scientific Claims

Using the present tense in scientific writing does not imply that a result is universally or permanently true. It reflects a convention of describing established knowledge, methods, and results as part of the current scientific discourse. The choice of tense should therefore not be confused with the strength or scope of a scientific claim.

2.1.4 Other Language Elements

Bullet Lists Bullet or enumerated lists can be an effective stylistic device for drawing the reader's attention to a set of important statements. However, they are not an excuse for abbreviated or careless prose. Bullet lists should be punctuated consistently, and each item should follow a consistent grammatical structure (e.g., all full sentences or all sentence fragments).

Bad Example	**Better Solution (i)**	**Better Solution (ii)**
• First we review the list. • Define the list • The list needs to be made. • List design	• Review the list • Define the list • Make the list • Design the list	• Reviewing • Defining • Making • Designing

Lists Are Not a Substitute for Argument

Bullet lists are a structural aid, not a replacement for reasoning or explanation. They should support the surrounding text, not stand in for it. Every list should be introduced in the running text and, where necessary, followed by an explanation of how the listed items relate to the overall argument.

Abbreviations Abbreviations are an important and increasingly common feature of contemporary English, widely used for convenience and space-saving. They take the form of shortened words, acronyms, or other abbreviations:

- *Shortened words* are often used without the writer being aware of the original form. For example, *bus* originates from *omnibus*, which is rarely used today. However, in formal writing, *refrigerator* is preferable to the informal *fridge*.
- *Acronyms* are formed from the initial letters of a name or phrase and are pronounced as words (e.g., AIDS = Acquired Immune Deficiency Syndrome).
- *Other abbreviations* are pronounced as individual letters. These include names of countries, organizations, and companies (e.g., USA, BBC, IBM).

Some abbreviations are well established, such as DNA or DVD. In many cases, they are widely used even though most users may not know what the individual letters stand for. In contrast, more specialized abbreviations must be introduced explicitly and explained at first occurrence, typically in parentheses (e.g., *Starting from the*

resource-based view (RBV) of the firm, it is argued that ...).

After introducing an abbreviation, use it consistently and do not alternate between the full form and the abbreviated form (e.g., *An electrocardiogram (ECG) was obtained. The ECG was unremarkable.*). One exception applies: to avoid disrupting the reading flow, abbreviations at the beginning of a sentence should always be written out.

Avoid using different abbreviations for the same term. Before introducing a new abbreviation, check whether an established one already exists. This is generally preferable to inventing a new abbreviation.

Some abbreviations include a full stop to indicate a shortened form; however, there is a general tendency to omit full stops. The crucial point is to apply a consistent style throughout the thesis. Note that LaTeX inserts additional horizontal space after a full stop, assuming it marks the end of a sentence. When a period does not indicate sentence termination (e.g., in abbreviations), this spacing is undesirable. In such cases, we recommend using a non-breaking space, for instance via the tilde symbol "~".

Common Pitfall: *e.g.* vs. *i.e.*

The abbreviation *e.g.* means *for example*, whereas *i.e.* means *that is*. The two must not be confused.

- *e.g.* introduces one or more examples from a larger set.
- *i.e.* clarifies, specifies, or restates a statement without adding new information.

Both abbreviations are commonly followed by a comma and should be punctuated in the same way as their corresponding English phrases.

- *Several classification methods (e.g., SVMs, decision trees) are evaluated.*
- *The experiment is conducted on a single dataset (i.e., the training data).*

Definitions Definitions are not required in every case. However, if a term is used in a specific or non-standard way, it is essential to make its meaning explicit. In general, we distinguish between *small* and *large* definitions. Small definitions are introduced informally in the running text, whereas large definitions are formulated precisely using dedicated LaTeX environments (see Fig. 2.1).

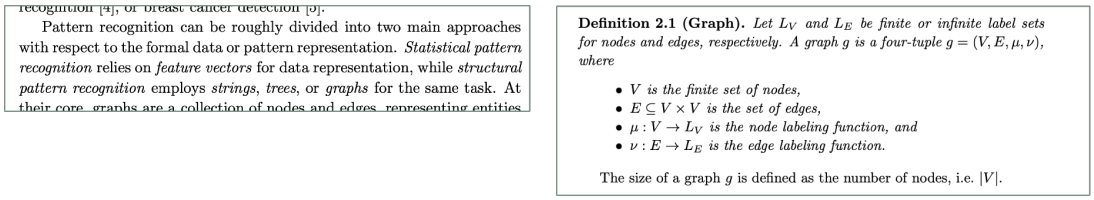


Figure 2.1: Small and large definitions in plain text and in the definition environment of LaTeX.

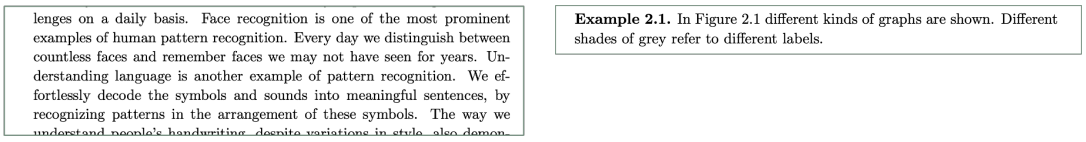


Figure 2.2: Small and large examples in plain text and in the example environment of LaTeX.

Do Not Overdefine

Definitions should be used selectively. Defining terms that are commonly known within the target audience can interrupt the reading flow and may appear condescending. A definition is appropriate when a term is used in a specialized, non-standard, or thesis-specific way, or when it is central to the argument of the work.

Examples Examples are used in academic writing to support arguments and to aid understanding. Well-chosen examples can make abstract ideas more concrete and accessible. Generalizations are often used to introduce a topic; adding an example helps to illustrate the point more clearly, e.g., *Many plants and animals are threatened by global warming. Polar bears, for example, are suffering from the lack of Arctic ice.*

As with definitions, we distinguish between *small* and *large* examples (see Fig. 2.2). There are standard formulations for introducing examples:

- for instance, for example (with commas):
  - *Some car manufacturers, for instance Hyundai, now offer ...*
  - *For example, Hyundai now offers ...*
- such as, e.g.:
  - *Many successful businessmen such as Bill Gates ...*
  - *This can be written at the beginning of the thesis (e.g., in the introduction).*

- particularly, especially (to emphasize a subset):
  - *Certain Master's programs, especially American ones, take ...*
  - *In particular, American programs ...*

Examples vs. Evidence

Examples help illustrate an idea, but they do not constitute scientific evidence. Claims must be supported by data, analysis, or citations, not by illustrative examples alone. Examples are most effective when used to clarify a concept whose validity has already been established.

2.2 Structure

A clear division of a thesis into chapters, sections, and paragraphs is crucial for readability. A well-structured text helps the reader understand both the overall argument and the role of individual components.

Before starting the actual writing process, the overall structure should be discussed with the supervisor. A structural skeleton of the thesis – showing the division into chapters, sections, and subsections, and indicating the core ideas covered in each section – serves as a solid basis for this discussion.

2.2.1 Rules for Sections

The word *section* is capitalized when used together with a specific numbering (and not capitalized otherwise):

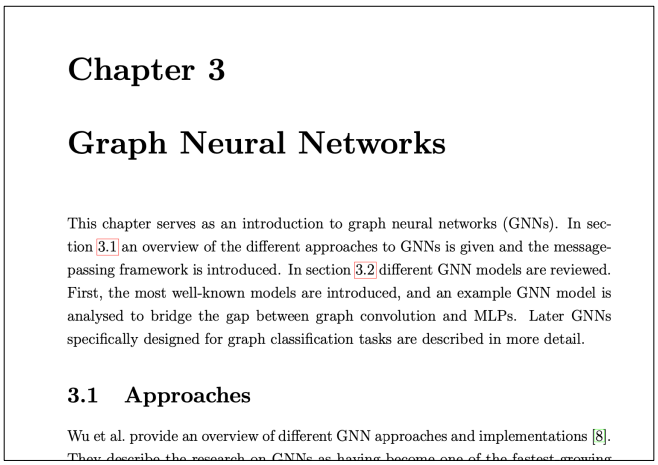
- *In Section 1.4 this method is described in more detail.*
- *This is described in more detail in the subsequent section.*

Sections Are a Reader Aid

Sections primarily serve the reader. They should reflect the logical structure of the argument, not the chronological order in which the work was carried out. A good section structure allows readers to locate information quickly and to understand how individual parts contribute to the overall thesis.

In the final thesis, we recommend briefly outlining the content of each chapter at its beginning by means of a short preamble. This preamble explains what is discussed in the chapter and how the sections relate to each other (see Fig. 2.3 for an example).

The same approach can also be useful for sections that contain many subsections: a short orienting paragraph at the beginning helps the reader understand the internal



Chapter 3

Graph Neural Networks

This chapter serves as an introduction to graph neural networks (GNNs). In section 3.1 an overview of the different approaches to GNNs is given and the message-passing framework is introduced. In section 3.2 different GNN models are reviewed. First, the most well-known models are introduced, and an example GNN model is analysed to bridge the gap between graph convolution and MLPs. Later GNNs specifically designed for graph classification tasks are described in more detail.

3.1 Approaches

Wu et al. provide an overview of different GNN approaches and implementations [8]. They describe the research on GNNs as having become one of the fastest growing

Figure 2.3: A good preamble helps the reader to find their way around your work.

structure and the progression of ideas. For the sake of readability and coherence, strive for consistency—if you use preambles at the chapter level, apply them systematically, and use section-level preambles in a consistent manner where appropriate.

Each section and subsection should address a specific topic and therefore requires a descriptive and informative title. Section and subsection titles should fit on a single line and clearly indicate the content that follows. Always capitalize the first word as well as all nouns, pronouns, verbs, adjectives, and adverbs in titles (e.g., *The Old Man and the Sea*).

Informative Titles Matter

Section titles are not decorative. A reader should be able to understand the structure and content of the thesis by scanning the table of contents alone. Avoid vague titles such as *Details*, *Experiments*, or *Miscellaneous*.

Not every chapter must be subdivided into sections. In particular, introductory chapters are often clearer when written as a continuous, well-structured text without explicit section headings. Sections should be used when a chapter contains multiple subtopics that are best explained independently. Conversely, sections and subsections should be avoided when the text is very short, when subtopics are strongly interrelated, or when additional structure would unnecessarily interrupt the reading flow.

Remember: Each (sub)section must be followed by at least one additional (sub)section at the same hierarchical level. Moreover, the section hierarchy should be limited to a maximum of three levels.

2.2.2 Rules for Paragraphs

Paragraphs are the basic building blocks of academic writing. Each paragraph develops exactly one core idea, argument, or consideration that contributes to the overarching topic of the corresponding section or chapter.

One Paragraph = One Idea

A paragraph should focus on exactly one core idea. Mixing multiple ideas within a single paragraph makes the argument difficult to follow, while splitting one idea across several paragraphs weakens coherence. A useful rule of thumb is: *one paragraph answers one question.*

Before writing a paragraph, you should be clear about what you want to accomplish with it. Typical purposes include:

- providing an example,
- making and elaborating a central point,
- explaining a cause or consequence,
- introducing an algorithm,
- describing advantages and/or drawbacks of a method,
- discussing a table or figure,
- drawing conclusions from an experiment,

Once the purpose of a paragraph is clear, one can formulate one to three *core sentences* that capture its main idea. These may initially be written as shorthand notes.

Paragraph length varies depending on content, but should typically not be shorter than four or five sentences.

Paragraph Length Is Not Arbitrary

Very short paragraphs often lack sufficient development, while very long paragraphs tend to contain multiple ideas. Both hinder readability. If a paragraph feels too long, it usually contains more than one core idea and should be split.

In many cases, the first sentence introduces the topic, while subsequent sentences provide definitions, examples, explanations, reasons, or summaries:

*(**Topic**) The rate of home ownership varies widely across the developed world. (**Example 1**) Germany, for instance, has one of the lowest rates, at 42 per cent, while*

*in Spain it is twice as high, 85 per cent. (**Example 2**) Both the USA and Britain have similar rates of about 69 per cent. (**Reason**) The reasons for this variation appear to be more cultural and historic than economic. (**Summary**) There appears to be no conclusive link between national prosperity and the number of homeowners.*

Paragraphs should not stand in isolation. They are typically linked to the preceding paragraph in order to maintain a coherent flow of argument.

Paragraphs can be linked in several ways:

- by using demonstrative pronouns that refer back to previously introduced concepts (e.g., *this idea*, *these algorithms*),
- by using linking words that indicate *addition*, *contrast*, or *consequence*,
- by explicit signposting that tells the reader what the paragraph does (e.g., previewing, returning to, or summarizing a topic).

Transitions Are Mandatory

A paragraph without a clear connection to its predecessor forces the reader to reconstruct the logical relationship. Explicit transitions reduce cognitive load and improve coherence. *Never* assume that the connection between paragraphs is obvious to the reader.

2.2.3 Scientific Argumentation

A central goal of a scientific thesis is not only to describe methods and results, but to *argue* for their meaning and relevance. Scientific argumentation refers to the structured presentation of claims that are supported by evidence and justified through reasoning.

In contrast to opinion-based writing, scientific arguments must always be grounded in observable data, formal analysis, or established theory. The quality of a thesis is therefore determined not only by the results obtained, but also by how convincingly these results are embedded into a coherent argumentative structure.

At a minimum, a scientific argument consists of the following components:

- *Claim*: A statement that the author wants the reader to accept.
- *Evidence*: Empirical results, experimental observations, formal proofs, or references to prior work that support the claim.

- *Reasoning*: An explanation of *why* the evidence supports the claim.

For example, stating that *the proposed method outperforms the baseline* is a claim. Reporting accuracy values, error rates, or statistical test results constitutes evidence. Explaining why these results indicate a meaningful improvement provides the necessary reasoning.

Scientific argumentation typically operates at multiple levels within a thesis:

- at the level of individual paragraphs (each paragraph develops one argument),
- at the level of sections (each section supports a sub-goal of the thesis),
- and at the level of the entire thesis (all arguments contribute to answering the central research question).

Claims Must Be Proportional to Evidence

Scientific arguments must be formulated in proportion to the strength of the available evidence. Strong, general claims require strong and comprehensive evidence, while limited or exploratory results should be accompanied by cautious and qualified formulations.

A frequent mistake is to confuse *description* with *argumentation*. Describing results means reporting what can be observed in data, tables, or figures. Argumentation begins when the author interprets these observations, relates them to existing research, and explains their implications. Both aspects are essential, but they must be clearly distinguished.

Another common pitfall is to present results without explicitly stating the underlying claim. Readers should never be forced to infer the author's conclusions implicitly. Instead, claims should be stated clearly and then supported step by step.

Finally, scientific argumentation also includes acknowledging limitations. Discussing weaknesses, assumptions, or unresolved questions does not weaken an argument; on the contrary, it demonstrates scientific maturity and strengthens the credibility of the work.

Checklist: Language and Structure

Before submitting your thesis, verify that the following points are fulfilled:

- The language is formal, objective, and appropriate for scientific writing.
- Colloquialisms, idiomatic expressions, filler words, and emotional or evaluative language are avoided.
- Personal expressions (e.g., *I think*, *in my opinion*) and rhetorical questions are not used.
- Absolute or exaggerated statements are avoided unless fully justified by evidence.
- Negative results are reported neutrally and analytically, without apology or defensiveness.
- Terminology, notation, spelling conventions, and abbreviations are used consistently throughout the thesis.
- Each technical term is introduced clearly at first occurrence.
- Terms are defined only where necessary; standard concepts are not overdefined.
- The same concept is not referred to using multiple synonyms without reason.
- Verb choices accurately reflect the strength and certainty of the underlying claims.
- Claims are proportional to the available evidence.
- The present tense is used consistently for methods, results, figures, and cited work.
- Any deviation from the default tense usage (e.g., for future work) is intentional and justified.
- Informal or unsuitable phrasal verbs are avoided or replaced with formal alternatives.
- Examples are used to illustrate concepts but are not confused with scientific evidence.
- Bullet and enumeration lists support the surrounding text and do not replace explanation or argumentation.
- Lists are grammatically consistent and properly introduced in the running text.
- Definitions are used selectively and presented with an appropriate level of formality.
- The overall structure follows a logical argumentative order rather than the chronological research process.
- Chapter, section, and subsection titles are descriptive and informative.
- Each section contributes clearly to the overall argument of the thesis.
- Each paragraph develops exactly one core idea.
- Paragraphs are of appropriate length (neither fragmentary nor overloaded).
- Clear transitions link paragraphs and guide the reader through the argument.
- Claims, evidence, and reasoning are clearly distinguished.
- Results are not merely described but embedded into explicit arguments.
- Interpretations are clearly separated from observations.
- Limitations, assumptions, and uncertainties are acknowledged where appropriate.

If you can confidently answer "yes" to all items above, the linguistic and structural quality of your thesis is likely on a solid level.

Chapter 3

Citations and References

3.1 Plagiarism

Academic writing builds on existing research and ideas. It is therefore essential to indicate clearly which sources have been used and how they have influenced the present work. This is achieved through *citations* and *references*. Citations are short markers included directly in the text (e.g., numbers or author names in brackets), whereas references provide the full bibliographic details of the cited sources (see Fig. 3.1).

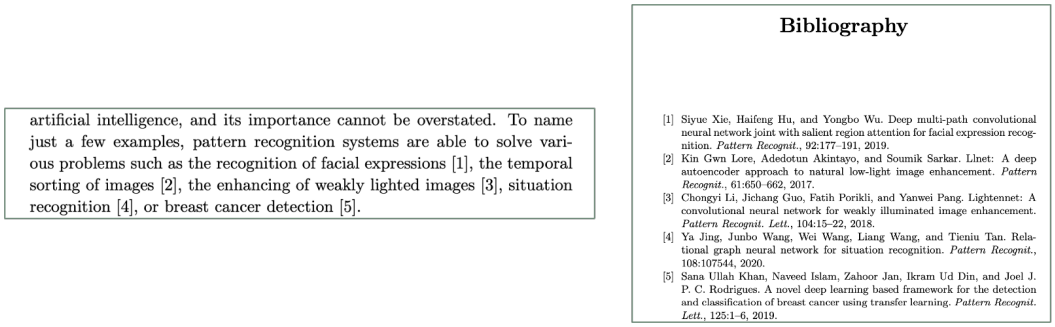


Figure 3.1: Citations appear in the text; References provide the full bibliographic details.

Citations Are Not References

A citation is the short marker that appears in the text, whereas a reference is the full bibliographic entry listed in the bibliography. Citations point to references; they are not interchangeable.

There are three principal reasons for providing references and citations:

1. To demonstrate familiarity with authoritative work in the field, thereby strengthening the credibility of the thesis.

2. To enable readers to locate the original sources and explore the topic in more depth.

3. To avoid *plagiarism*.

In academic contexts, ideas and formulations are regarded as the intellectual property of the individuals who originally developed or published them. Plagiarism therefore means presenting someone else's ideas or words as one's own without appropriate citation. It is considered a serious academic offence (in this sense, the present notes deliberately constitute a bad example, as some passages intentionally paraphrase or reproduce material from standard textbooks[1] in order to illustrate best practices in academic writing without academically valid citations. However, this is acceptable in the present context, as the document is not intended as a scientific contribution but as an internal pedagogical compilation of best practices for academic writing).

There are several important reasons why plagiarism must be avoided:

- It demonstrates that you understand and respect the conventions of academic writing.
- It supports the development of your own understanding and critical thinking.
- It prevents severe consequences, as plagiarism is easily detected using specialised software and may lead to failing a course or even expulsion from the university.

Lack of Intent Is Not a Defence

Not knowing the rules of plagiarism or lacking time to rewrite material in one's own words does not excuse plagiarism. Academic responsibility includes learning and applying proper citation practices. Unintentional plagiarism is still plagiarism.

In general, any idea, method, data, or formulation that is not common knowledge or the result of your own original work must be cited and referenced. Common knowledge refers to facts or statements that are widely known and undisputed within the relevant academic community. Such information does not require citation. If you are unsure whether something counts as common knowledge, it is safer to provide a

[1]
- Bailey, Stephen. *Academic Writing: A Handbook for International Students.* Routledge, 2014.
- Strunk, William, and E. B. White. *The Elements of Style.* SWB Books, 1918.

citation.

Another challenge is that academic writing requires a balance between two competing expectations:

- demonstrating familiarity with key contributions in the field by citing relevant literature, and
- explaining these ideas in one's own words while developing original conclusions.

Successfully meeting both expectations is a central skill in academic writing.

3.2 Citing

There are various systems of citing in use in the academic world. They typically follow one of three basic approaches:

- parenthetical citations,
- numerical citations,
- note citations.

In our template, we use a numerical citation system, namely the *Vancouver system*. Numbers in square brackets are inserted after the cited statement and link to a numbered list of references at the end of the main text (the *Bibliography*; details follow in the next subsection). With LaTeX, citing is straightforward using the `\cite{...}` command (→ use the templates).

A citation is an annotation to a sentence. It is not part of the sentence itself and should not play a grammatical role. In other words, if the citation is removed, the sentence must remain grammatically correct and complete.

- Bad example: *As it is reported in [17] ...*
- Better: *Smith [17] reports that ...*

Cite with Purpose

A citation should make clear why a particular source is mentioned and how it relates to your work. Citations are not decorative and should never be used without a clear conceptual connection.

Please avoid citing long ranges of references (e.g., *Many researchers have studied these normal forms [17–22].*). Such citations obscure the contribution of individual

works and make it unclear why the references are relevant.

In LaTeX, the tilde symbol "~" behaves like a space but prevents a line break. We therefore recommend using a tilde before citations in order to avoid line breaks immediately preceding a citation.

3.3 Paraphrasing and Summarizing

When acknowledging the work of others, one option is to quote directly and provide a reference to the original source:

- *According to Smith [17]: "The point is not that the state is in retreat but that it is developing new forms of power."*

In this case, it is clear to the reader that Smith's original wording has been reused. Quotations are often introduced by a phrase that identifies the source and explains how the quotation fits into the argument:

- *As James [17] remarked, "Martin's concept of internal space requires close analysis."*

Using quotations brings the original wording of another author into your text. This can be useful

- when the original phrasing is distinctive,
- when the original formulation is more concise than a paraphrase,
- when the quoted statement is well known.

Use Quotations Sparingly

Quotations should not be excessively long and quotations should be used selectively. Overuse of quotations can interrupt the flow of the text and may give the impression that the writer is not fully in command of the material. In most cases, paraphrasing or summarizing is preferable.

In academic writing, ideas are most commonly incorporated through *paraphrasing* and *summarizing* rather than through direct quotation. These techniques allow you to include the ideas of other authors while demonstrating your own understanding.

- *Paraphrasing* restates the original content using substantially different wording and structure while preserving the original meaning.

- *Summarizing* condenses the original text by retaining only the main points.

Paraphrasing and summarizing are often used together. While summarizing reduces the amount of information, paraphrasing reformulates it in your own words.

Paraphrasing Still Requires Citation

Even when a text is fully paraphrased or summarized, the original source must still be cited. Changing the wording does not make an idea your own. Failure to cite paraphrased material constitutes plagiarism.

Effective paraphrasing is a key academic skill and helps to avoid plagiarism. A good paraphrase typically

- uses a different sentence structure,
- employs largely different vocabulary,
- preserves the original meaning,
- may retain standard phrases that are in common use.

Common paraphrasing techniques include:

- replacing words with appropriate synonyms (where true synonyms exist),
- changing word classes (e.g., explanation → explain; mechanical → mechanize),
- modifying word order or sentence structure.

Summarizing is equally important and requires

- careful selection of the most important aspects,
- clear and concise formulation,
- accuracy with respect to the original meaning.

A possible process for summarizing is:

- read the original text carefully and clarify unfamiliar terms,
- identify and mark the key points,
- take notes and paraphrase where possible,
- write the summary based on these notes,
- verify that the summary is accurate and complete.

Both paraphrases and summaries should be written using impersonal language:

- *It is generally accepted that ...*
- *It is widely agreed that ...*
- *It is probable that ...*

Minority viewpoints can be indicated using formulations such as:

- *It can be argued that ...*
- *One view is that ...*
- *Another opinion is that ...*

When incorporating paraphrases, summaries, or quotations, the author of the original source is often mentioned explicitly in the sentence. In such cases, *referring verbs* are used:

- *Abrams [17] reports that ...*

Different referring verbs convey different attitudes toward the cited work:

Agrees	Emphasises	Points out
Articulates	Explains	Proves
Assumes	Finds	Refutes
Believes	Highlights	Remarks
Claims	Identifies	Reports
Clarifies	Illuminates	Reveals
Concludes	Illustrates	Shows
Confirms	Insists	States
Demonstrates	Justifies	Supports
Denies	Mentions	Suggests
Describes	Observes	Uncovers
Discusses	Outlines	Verifies

Referring Verbs Express Evaluation

Referring verbs implicitly convey your stance toward the cited work. Choosing an inappropriate verb may unintentionally overstate or understate the strength of a claim. Select referring verbs carefully to reflect your intended evaluation.

When referring to authors within the running text, the form depends on the number of authors of the cited work:

- For a single author, use the author's surname:
  - *According to Smith [17], the proposed method improves robustness.*
- For two authors, give both surnames, connected by *and*:
  - *Hobolt and Tilley [2] argue that voter turnout is influenced by ...*
- When a source has three or more authors, the abbreviation *et al.* (from the Latin *et alia*, meaning "and others") should be used:
  - *According to Hobolt et al. [2], many Americans fail to vote.*

Note that *et al.* is typically typeset in italics and followed by a period. Regardless of the number of authors cited in the text, the full list of authors must always be given in the corresponding bibliography entry. That is, the abbreviation *et al.* should be used only in citations within the text and must not be used in the bibliography, where all authors have to be listed in full.

3.4 Bibliography

At the end of the thesis, there must be a list of all references cited in the text, known as the *bibliography*. The bibliography provides the reader with sufficient information to locate the cited sources if further details are required. We strongly recommend using BibTEX to manage the bibliography.

The provided templates automatically compile the bibliography based on the citations used in the main text. In the Vancouver system (used in the templates), references are ordered according to their first appearance in the text.

To ensure consistent formatting (e.g., *Pattern Recognition Letters* vs. *Pat. Recognit. Lett.* vs. *PRL* or *H. Bunke* vs. *Bunke, Horst*, vs. *Bunke, H.*), we strongly recommend choosing a single, reliable platform from which the majority of references can be imported as BibTEX records. We recommend `https://dblp.org` where BibTEX records for scientific publications can be downloaded directly (see Fig. 3.2).

References that cannot be found on the chosen platform must be defined manually and carefully adjusted to match the style and level of detail of the remaining entries.

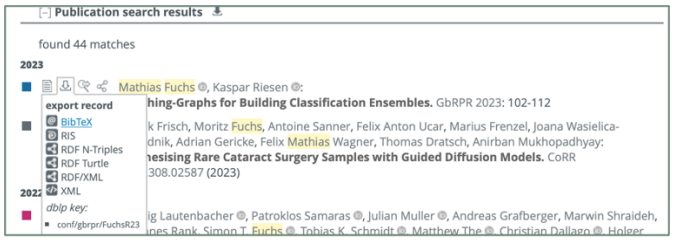


Figure 3.2: On `https://dblp.org` BibTEX records for scientific publications can be downloaded directly.

One Source of Truth for References

All bibliographic information should be maintained exclusively in BibTEX entries. References must never be typed manually into the bibliography. This ensures consistency, correctness, and reproducibility. Inconsistent reference formatting gives the impression of careless work, even if the content of the thesis is strong. A clean and uniform bibliography reflects scientific discipline and attention to detail.

As a very rough guideline for the number of references, the length of the thesis can be used as an orientation. For example, a thesis of approximately 25 pages typically cites around 25 references. This number may vary depending on the topic and research style.

Finding relevant literature is partly systematic and partly exploratory. The following procedure has proven useful:

- First, develop a basic understanding of how the research field is structured (e.g., using `Wikipedia` or overview articles).
- Second, identify survey papers. These provide structured overviews and reference the most influential publications.
  - Compile a list of key authors, datasets, methods, and concepts.
  - Identify relevant research groups, conferences, and journals.
- Third, use the identified keywords to search platforms such as `dblp.org`, `scholar.google.com`, `sciencedirect.com`, or similar.
  - Identify highly cited papers.
  - Use forward citation searches to discover more recent related work.
  - Explore the publication profiles of key authors to identify additional relevant work.

Quality Over Quantity

A bibliography should reflect relevance, not completeness. Citing many loosely related papers is less valuable than citing a smaller number of highly relevant and well-integrated sources.

Note that we recommend avoiding references to general websites in the bibliography (whenever possible, cite peer-reviewed papers, books, or technical reports instead). If web sources are unavoidable, they should be used sparingly and only when no suitable scientific publication is available. If a web source is cited, ensure that it is authoritative, stable, and directly relevant.

Checklist: Citations and References

Before submitting your thesis, ensure that the following points are satisfied:

- All ideas, methods, data, and formulations taken from other sources are properly cited.
- Citations and references are used consistently and correctly throughout the thesis.
- Paraphrased and summarized material is always accompanied by a citation.
- Quotations are used sparingly and only where the original wording is essential.
- Referring verbs are chosen carefully to reflect the intended evaluation of cited work.
- The bibliography is complete, consistent, and automatically generated using BibTeX.
- Reference formatting is uniform and follows the selected citation style.
- Web sources are avoided where possible or used only when scientifically appropriate.

If all items above can be answered confidently, the thesis meets core academic standards for citation practice and data description.

Chapter 4

Describing and Reporting

4.1 Describing the Experimental Design

In empirical theses, the experimental design determines how results are obtained and how they should be interpreted. A clear and precise description of the experimental setup is therefore essential for transparency, reproducibility, and credibility.

The goal of writing about experimental design is not to document every implementation detail, but to enable the reader to understand:

- how the experiments are conducted,
- why specific design choices are made,
- under which conditions the results are valid.

At a minimum, the experimental design should specify:

- the datasets or data sources used,
- the evaluation protocol (e.g., train/test splits, cross-validation),
- baseline methods or reference systems,
- evaluation metrics and performance measures,
- relevant parameters and configuration choices.

All elements that influence the reported results must be described sufficiently for the experiment to be reproducible. The level of detail should be proportional to the importance of the design component:

- Core design choices that directly affect results require detailed explanation.

- Standard or widely used components may be described briefly with a citation.
- Implementation details that do not affect interpretation should be omitted or moved to the appendix.

Design decisions should be justified concisely and objectively. Common forms of justification include:

- evidence from preliminary evaluations (e.g., *In preliminary evaluations, we find that ...*).
- reference to established practice in the literature,
- practical constraints (e.g., data availability, computational resources),
- alignment with the research question or hypothesis.

Justifications should be factual and restrained. Avoid narrative formulations that describe personal decision processes.

Description vs. Justification

Describe *what* was done before explaining *why* it was done. Explanations should justify design choices, not recount the chronological history of the project.

The experimental design provides the frame within which results must be interpreted. When discussing results, the reader should not encounter unexplained datasets, metrics, or baselines. All such elements must have been introduced beforehand.

4.2 Basic Comparisons

Comparisons are frequently required in academic writing. It is therefore essential to state clearly what is being compared and to define the reference group explicitly. Comparisons without a clear reference point are ambiguous and should be avoided.

The two basic comparative forms in English are:

- *-er* is added to one-syllable adjectives and to two-syllable adjectives ending in *-y* (where *-y* changes to *-i*):
  - France is *larger* than Switzerland.
  - The students were *happier* after the exam.

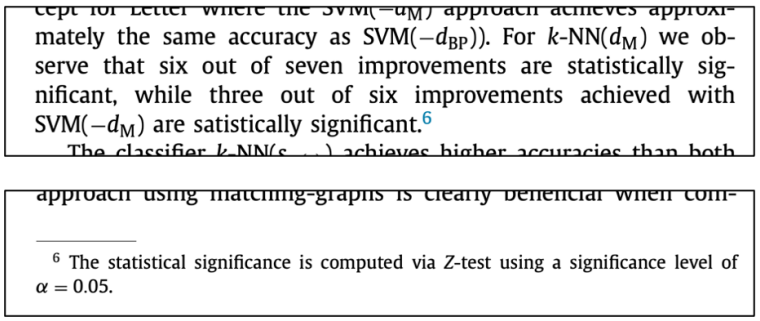


Figure 4.1: If you report *statistically* significant differences, a statistical test must be performed and specified.

- *more ...* is used with most adjectives of two or more syllables:
  - Learning Chinese is *more* difficult than learning English.

Comparisons can be refined using adverbs such as:

- slightly,
- considerably,
- significantly,
- substantially.

For example:

- France is *substantially* larger than Switzerland.
- Switzerland is *slightly* smaller than Holland.
- Winters in Poland are *significantly* colder than in Portugal.

In academic writing, the term *significant* has a precise statistical meaning. If statistical significance is claimed, an appropriate statistical test must be conducted and its parameters (e.g., confidence level or p-value) must be reported. If no statistical test is involved, alternative terms such as *noticeable*, *considerable*, or *pronounced* should be used instead.

Similarity can be expressed using *as ... as* or *the same as*:

- The population of France is *the same as* the population of Britain.
- Summers in Tokyo are *as wet as* in Singapore.

Quantitative comparisons may use expressions such as *twice as ... as* or *half as ... as*:

- Britain is *half as large as* France.

When using superlatives, the comparison set must always be specified. Expressions such as *the cheapest car* or *the best method* are meaningless without a clearly defined reference group. Instead, specify the scope explicitly (e.g., *the cheapest car in the Ford range*).

Note that *the most* and *the least* are followed by an adjective:

- *The most interesting example is Ireland.*

The expressions *the most* and *the fewest* can also be used with quantities:

- *The fewest students studied biogenetics.*

Comparisons in Scientific Writing

Comparisons should always be precise, contextualized, and justified. Avoid vague or absolute statements, define the comparison set explicitly, and distinguish clearly between linguistic emphasis and statistical significance.

4.3 Generalizations

Generalizations provide a simplified view of a topic and are often easier to understand than precise numerical descriptions. When writing, the author must carefully decide when a generalization is acceptable and when a higher level of accuracy is required.

- Easy to understand: *The majority of smokers in Britain are women.*
- Higher accuracy: *Of all smokers in the UK, 56.2 percent are women and 43.8 percent are men.*

Generalizations can be formulated in two standard ways:

1. Using the plural form:
    - *Computers* have transformed the way we live.
2. Using the singular form with the definite article:
    - *The computer* has transformed the way we live.

In academic writing, unsupported or absolute generalizations must be avoided. Statements such as *Crime is linked to poor education* are problematic because they ignore exceptions and oversimplify complex relationships. As a result, a cautious and qualified writing style is required.

Caution can be expressed linguistically in several ways:

- Using modal verbs: *Crime may/can/might be linked to poor education.*
- Using adverbs of frequency or degree: *Crime is frequently/usually/generally linked to poor education.*
- Using tentative verbs: *Crime tends to be linked to poor education.*

Another way to soften generalizations is to modify adjectives using terms such as *quite*, *rather*, or *fairly*. The term *quite* is typically used with a positive connotation, whereas *rather* often introduces a negative or critical nuance:

- a *fairly* accurate summary
- a *rather* inconvenient location
- *quite* a significant discovery

Hedging and Scientific Caution

Careful use of tentative language (also known as *hedging*) is a hallmark of academic writing. It allows authors to present claims proportionally to the available evidence and to acknowledge uncertainty where appropriate.

Beyond generalizations, cautious language is particularly important in several other contexts:

- when formulating hypotheses that still need to be tested,
- when discussing empirical results that may not be conclusive,
- when commenting on or evaluating the work of others,
- when making predictions,
- when drawing conclusions from limited data.

Strong Claims Require Strong Evidence

The stronger and more general a claim is, the stronger the evidence must be. When evidence is limited, tentative formulations are not a weakness but a sign of scientific rigor.

4.4 Language of Numbers

Numbers are frequently used in academic writing to describe quantities, trends, and relationships. When reporting numerical information, clarity, precision, and consistency are essential.

For example:

- Approximately 1,800 children between the ages of five and 12 years are randomly selected[1].
- The earth's atmosphere appears to be gaining 3.3 billion metric tons of carbon annually.

When combining numbers with *hundred*, *thousand*, or *million*, no plural *s* is used:

- Six million people live there.
- Millions of people live there.

As a general stylistic convention, whole numbers from one to ten are written as words, while numbers above ten are written as digits:

- *Five* people normally work in the cafe, but at peak times this can rise to *14*.

Consistency Matters More Than the Rule

The one-to-ten rule is a guideline, not a law. In technical contexts (e.g., tables, equations, or measurements), digits are often preferred throughout. Whatever convention is chosen, apply it consistently.

Rates and proportions are commonly expressed as percentages:

- The literacy rate rose to 75%.

Percentages are also frequently used to describe changes. It is important to distinguish clearly between *percentage* and *percentage points*. The former refers to a relative change, while the latter refers to an absolute difference between percentages.

For example, if inflation drops from three percent to two percent, then you can say that inflation decreases *by one percentage point*, or inflation decreases *by 33.3%*.

Percentage vs. Percentage Points

Confusing percentage changes with percentage points is a common and serious error. Always verify whether you are describing an absolute difference or a relative change.

[1] In English, commas (not inverted commas) are used to separate numbers greater than 999. A comma is placed every third digit from the right: *More than 1,500,000 people turned up to protest.*

In some cases, percentages can be rephrased using qualitative descriptions:

Percent	Rephrasing
$< 5\%$	tiny minority
5–20%	small minority
21–39%	minority
40–49%	substantial/significant minority
51–55%	small majority
56–79%	majority
80–95%	large majority
$> 95\%$	vast majority

While accurate numerical reporting is important, an excessive use of statistics can reduce readability. If the exact number is not crucial, approximate expressions such as *few*, *several*, *various*, *dozens*, or *scores* may be preferable.

A variety of standard expressions can also be used to present and simplify numerical information:

Expression	Example
one in x	one in three engineering students is from China
twice/three times as many	twice as many women as men study business law
a five/tenfold increase	there was a fivefold increase in the price of oil
to double / to halve	the rate of infection halved after 2001
the highest / the lowest	the lowest rate of home ownership was in Germany
a quarter / a fifth	a fifth of all employees leave every year
the majority / minority	the majority of births take place in hospital
on average / the average	on average, each judge hears two cases per day
a small / large proportion	the website generates a large proportion of its sales

4.5 Visual Information

Visual information – namely figures and tables – is an efficient way of presenting large amounts of data in a compact and accessible form. Readers of BSc or MSc theses often scan figures and tables before reading the full text. It is therefore essential that all visuals are well structured, clearly labeled, and largely self-explanatory.

Titles and captions play a central role:

- Titles should be concise and clearly describe the content and purpose of the figure or table.

- Captions should also be concise and should guide the reader toward the key message or finding.
- Column headers, axis labels, legends, and figure annotations must be complete and unambiguous.

A Caption Is Not a Decoration

A reader should be able to understand the purpose and structure of a figure or table by reading the caption alone. Captions should explain *what* is shown and *why* it is shown.

Tables must be easy to read and consistently formatted. LaTeX provides extensive support for high-quality tables. Compare, for instance, the unformatted standard Table 4.1 with the more elaborated Table 4.2. Consult, the wikibook *LaTeX/Tables* for guidance on table design.

Table 4.1: Example of an un-formatted standard table.

Value A	Value B (Set 1)	Value B (Set 2)
Medium	10.34	100.12
Low	2.10	3.67
High	99.00	12.45

Table 4.2: Well-formatted table with aligned decimal values and grouped columns.

	Value B	
Value A	**Set 1**	**Set 2**
Medium	10.34	100.12
Low	2.10	3.67
High	99.00	12.45

When using images, screenshots, or scans, copyright issues must be treated with care. Prefer figures that you have created yourself. Redrawing an existing figure does *not* remove the obligation to cite the original source.

Copyright and Figures

If a figure is based on or adapted from an existing source, this must be clearly stated in the caption and the original source must be cited. When in doubt, assume that a citation is required.

Figures must be displayed at sufficient resolution, with legible fonts and clear labels. Use consistent typography and appropriate legends. Pay particular attention to precision:

- correct use of scale bars (e.g., in images or maps),

- appropriate and consistent units,
- complete and unambiguous labels and legends.

We strongly advise against using Excel for plotting research results. Instead, use tools such as `GnuPlot`, `MatplotLib`, `Seaborn`, or similar.

Although figures and tables convey information visually, they must always be referenced and described explicitly in the running text. References must be made using their *numbered identifiers*, not by vague spatial expressions such as *the figure above*, *the table below*, or *the table on the next page*.

Use the LaTeX commands `\label` and `\ref` to refer to figures and tables in a robust and unambiguous way. When referencing visuals, capitalize the words *Figure* and *Table* and include the corresponding number (e.g., *In Figure 17 we observe ...* or *Table 3 summarizes the results*).

Cross-Referencing Within the Thesis

In LaTeX, all structural elements (chapters, sections, figures, tables, appendices) should be assigned a `\label` and referenced using `\ref`. This ensures that numbering remains correct even if the document structure changes.

Be consistent throughout the thesis: either use the full forms *Figure* and *Table* or the abbreviations *Fig.* and *Tab.*, but never mix the two forms.

Changes over time or across conditions are often described visually. Useful vocabulary includes:

- rise, increase, climb, peak (for increasing values),
- level off, flatten, stabilise (for constant values),
- drop, fall, decrease, decline (for decreasing values),
- slightly, gradually, steadily, sharply, substantially (to describe magnitude),
- noun phrases such as *a slight drop*, *a sharp decrease*, *a steady decline*, or *a narrow plateau*.

Divide observations into separate paragraphs that each focus on one aspect of the data. Be selective: figures and tables complement the text and should highlight key trends, not duplicate numerical values already shown. Repeating exact numbers in

the text usually defeats the purpose of visualization.

Use varied and precise language for:

- referring to aspects of the visual:
  - *In terms of ...*, *Regarding ...*, *Looking at ...*, *Turning to ...*
- making comparisons:
  - *slightly more than*, *by far the highest*, *compared to*, *double the number of*, *outperforms*
- approximating values:
  - *nearly*, *roughly*, *almost*, *about*

Finally, ensure strict consistency between visuals and text. Labels, terminology, units, and numerical values must match exactly. Even minor inconsistencies can lead to significant confusion for the reader.

4.6 Description, Interpretation, Discussion

When reporting empirical findings, it is essential to clearly separate *description*, *interpretation*, and *discussion*. This distinction is particularly important when working with tables, figures, and quantitative evaluations. Blurring these roles reduces clarity and weakens the scientific structure of the thesis.

Typically, one starts with a *description*. At this stage, only explain how the visual is organized and what can be directly observed, without interpretation or explanation:

- What do the axes represent?
- What information is shown in rows and columns?
- How should the visual be read?

Typical formulations for descriptions are:

- Figure/Table 17 shows/illustrates/displays ...
- In Figure/Table 17 we show/illustrate/display ...

Interpretation begins where pure description ends. It explains what the reported results *mean* with respect to the research question, hypotheses, or expected behaviour. Interpretation addresses the question:

> *What do these observed results imply?*

Interpretation may directly follow the presentation of results or be deferred to a later chapter, depending on the structure of the thesis. It typically involves:

- explaining observed patterns or trends,
- relating results to hypotheses or assumptions,
- cautiously proposing explanations supported by the data.

Typical interpretative formulations include:

- In terms of accuracy, the new system outperforms the reference system in all but one case.
- Regarding runtime, a substantial decrease is observed for $n > 13$.

Interpretation must always remain traceable to the reported results and should be formulated using appropriate tentative language.

Finally, the *discussion* places interpreted results into a broader scientific context. Discussion answers the question:

> *Why are these results relevant in a broader context?*

Discussion typically includes comparison with related work, assessment of strengths and limitations, or implications for future research or applications.

Measure and Analyze at Least one Level Deeper

A well-established principle in experimental science and empirical research is that meaningful insight rarely arises from surface-level observations alone. Instead, one should aim to *measure and analyze at least one level deeper than the primary observation.*
If a method performs better, the next question is *why.* If two approaches differ in accuracy, one must investigate *which factors drive this difference.* If a trend appears in a figure, the underlying mechanism should be examined.
Applied to thesis writing, this principle implies that figures and tables should not merely be described. Beyond reporting visible effects, the writer is expected to interpret the results by discussing plausible explanations, controlling factors, limitations, and alternative interpretations where appropriate. Simply stating that a result exists is rarely sufficient for a scientific contribution.

Checklist: Describing and Reporting

Before submitting your thesis, ensure that the following points are satisfied:

- The experimental design is described clearly and precisely before any results are presented.
- All datasets, data sources, and preprocessing steps relevant to the results are specified.
- Evaluation protocols (e.g., train/test splits, cross-validation) are explained unambiguously.
- Baselines and reference methods are introduced and justified.
- Evaluation metrics and performance measures are defined and motivated.
- Design choices that influence results are justified objectively (e.g., literature, constraints, preliminary evaluations).
- Preliminary evaluations are clearly identified as such and are not overstated.
- Comparisons explicitly define the reference group and comparison criterion.
- Claims of statistical significance are supported by appropriate tests and reported parameters.
- Generalizations are used cautiously and are supported by data or qualified language.
- Absolute statements are avoided unless fully justified by evidence.
- Numerical values, units, and percentages are reported consistently and accurately.
- Percentages and percentage points are not confused.
- Figures and tables are clearly structured, legible, and self-contained.
- All figures and tables are referenced explicitly using labels and numbers (not positional phrases such as “above” or “on the next page”).
- Visuals are described in the text before they are interpreted.
- Description of visuals is clearly separated from explanation or speculation.
- Results are reported objectively using neutral, descriptive language.
- Interpretation is clearly distinguished from pure result description.
- Interpretations are traceable to the reported results and formulated using tentative language where appropriate.
- Discussion places interpreted results into a broader scientific context.
- Comparisons with related work are clearly identified as part of the discussion.
- Strengths, limitations, and assumptions of the results are explicitly acknowledged.
- Negative or inconclusive results are reported neutrally and linked to insight or learning.
- Results, interpretation, and discussion are not mixed within the same sentences or paragraphs.
- Claims made in this chapter are proportional to the strength of the evidence.
- No new experimental setup details are introduced after the results section begins.

If all items above can be answered confidently, the thesis meets the core academic standards for accurate description, interpretation, and scientific reporting.