LaTeX Workshop

Leiden Institute of Advanced Computer Science

Universiteit Leiden

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What is LaTeX?

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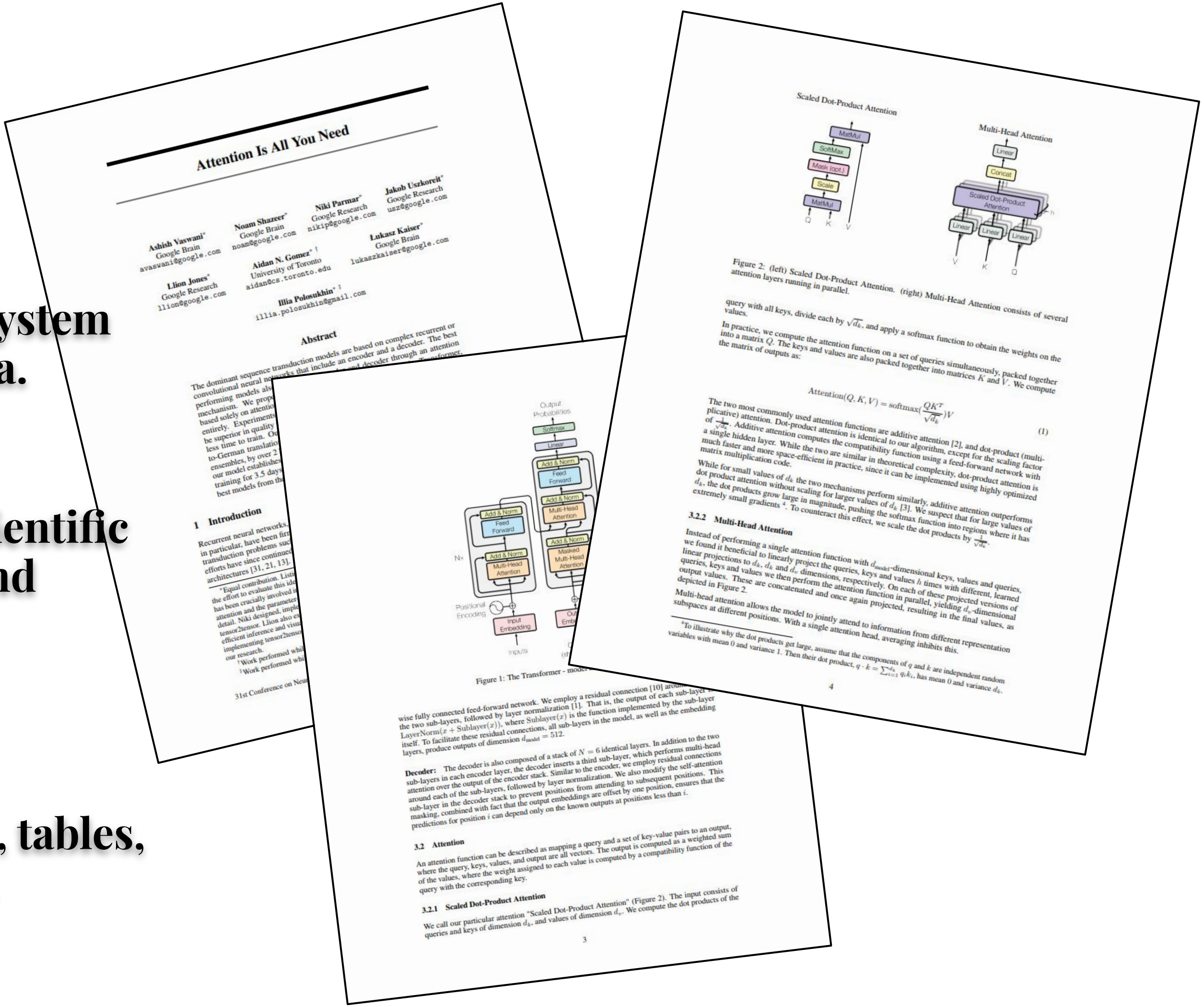
1. **LaTeX is a typesetting system widely used in academia.**

2. **Essential for writing scientific papers, assignments, and reports.**

3. **Supports complex mathematical formulas, tables, citations, and graphics.**



Why Use LaTeX?

1. **Professional Quality:**

   Documents look polished, standardized.

2. **Powerful for Math:**

   Handles formulas and equations easily.

3. **Efficient:**

   Automates numbering, references, and layouts.

4. **Widely Used:**

   Academic fields require LaTeX for papers.

Figure 2: (left) Scaled Dot-Product Attention. (right) Multi-Head Attention consists of several attention layers running in parallel.

query with all keys, divide each by $\sqrt{d_k}$, and apply a softmax function to obtain the weights on the values.

In practice, we compute the attention function on a set of queries simultaneously, packed together into a matrix Q. The keys and values are also packed together into matrices K and V. We compute the matrix of outputs as:

$$\mathrm{Attention}(Q,K,V) = \mathrm{softmax}(\frac{QK^T}{\sqrt{d_k}})V \tag{1}$$

The two most commonly used attention functions are additive attention [2], and dot-product (multiplicative) attention. Dot-product attention is identical to our algorithm, except for the scaling factor of $\frac{1}{\sqrt{d_k}}$. Additive attention computes the compatibility function using a feed-forward network with a single hidden layer. While the two are similar in theoretical complexity, dot-product attention is much faster and more space-efficient in practice, since it can be implemented using highly optimized matrix multiplication code.

While for small values of d_k the two mechanisms perform similarly, additive attention outperforms dot product attention without scaling for larger values of d_k [3]. We suspect that for large values of d_k, the dot products grow large in magnitude, pushing the softmax function into regions where it has extremely small gradients [4]. To counteract this effect, we scale the dot products by $\frac{1}{\sqrt{d_k}}$.

3.2.2 Multi-Head Attention

Instead of performing a single attention function with d_{model}-dimensional keys, values and queries, we found it beneficial to linearly project the queries, keys and values h times with different, learned linear projections to d_k, d_k and d_v dimensions, respectively. On each of these projected versions of queries, keys and values we then perform the attention function in parallel, yielding d_v-dimensional output values. These are concatenated and once again projected, resulting in the final values, as depicted in Figure 2.

Multi-head attention allows the model to jointly attend to information from different representation subspaces at different positions. With a single attention head, averaging inhibits this.

[4] To illustrate why the dot products get large, assume that the components of q and k are independent random variables with mean 0 and variance 1. Then their dot product, $q \cdot k = \sum_{i=1}^{d_k} q_i k_i$, has mean 0 and variance d_k.

4

Today's Topics:

1- File structure

2- Start Coding

3- Installing Python

4- Installing Start

5- Installing IDE

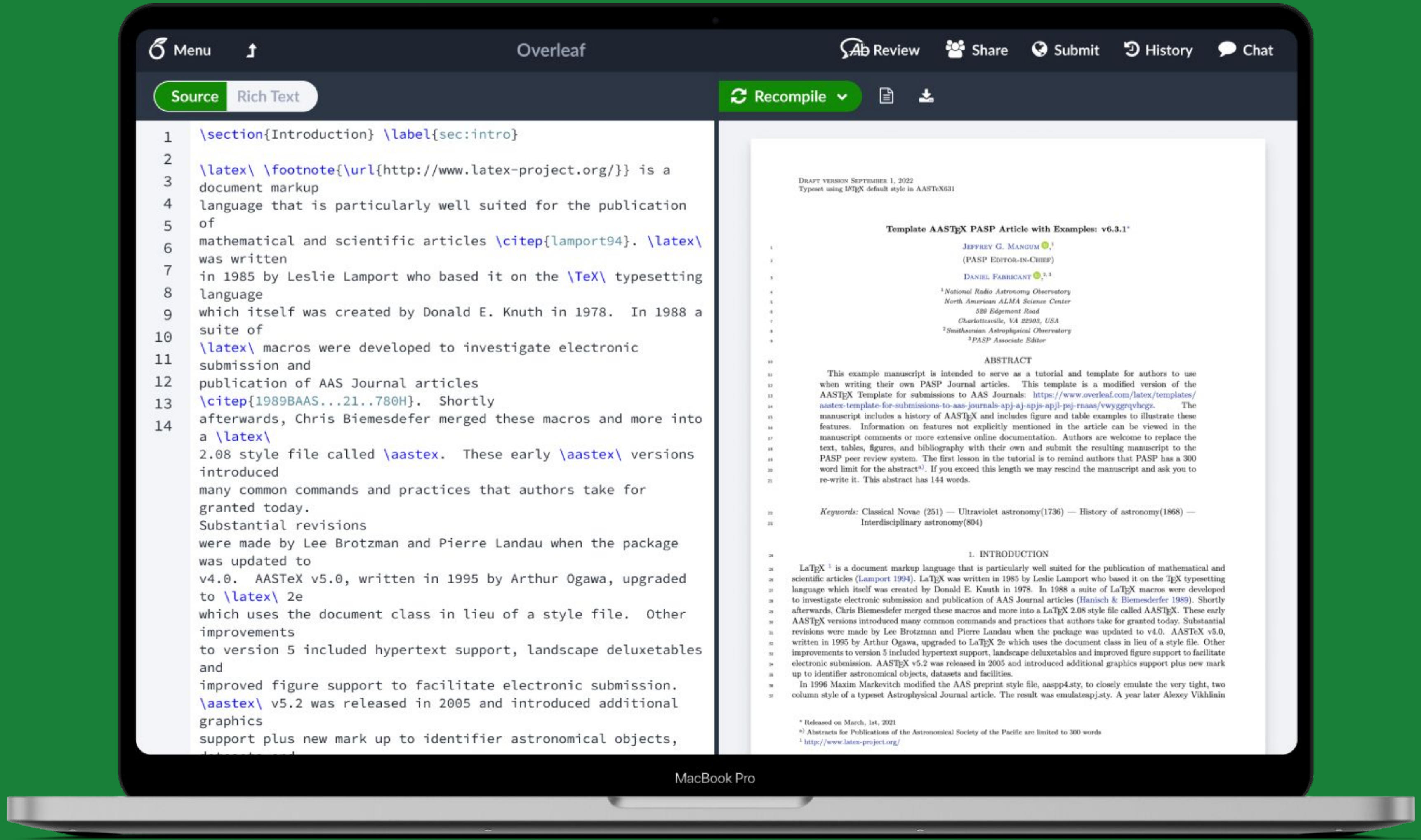
6- Lab exercise 1

Getting Started with LaTeX

Well…! Overleaf

Step-by-Step Guide:

- Go to overleaf.com
- Create an account or log in with university credentials.
- Start a new project and choose a template (e.g., article or report).


Menu
Overleaf
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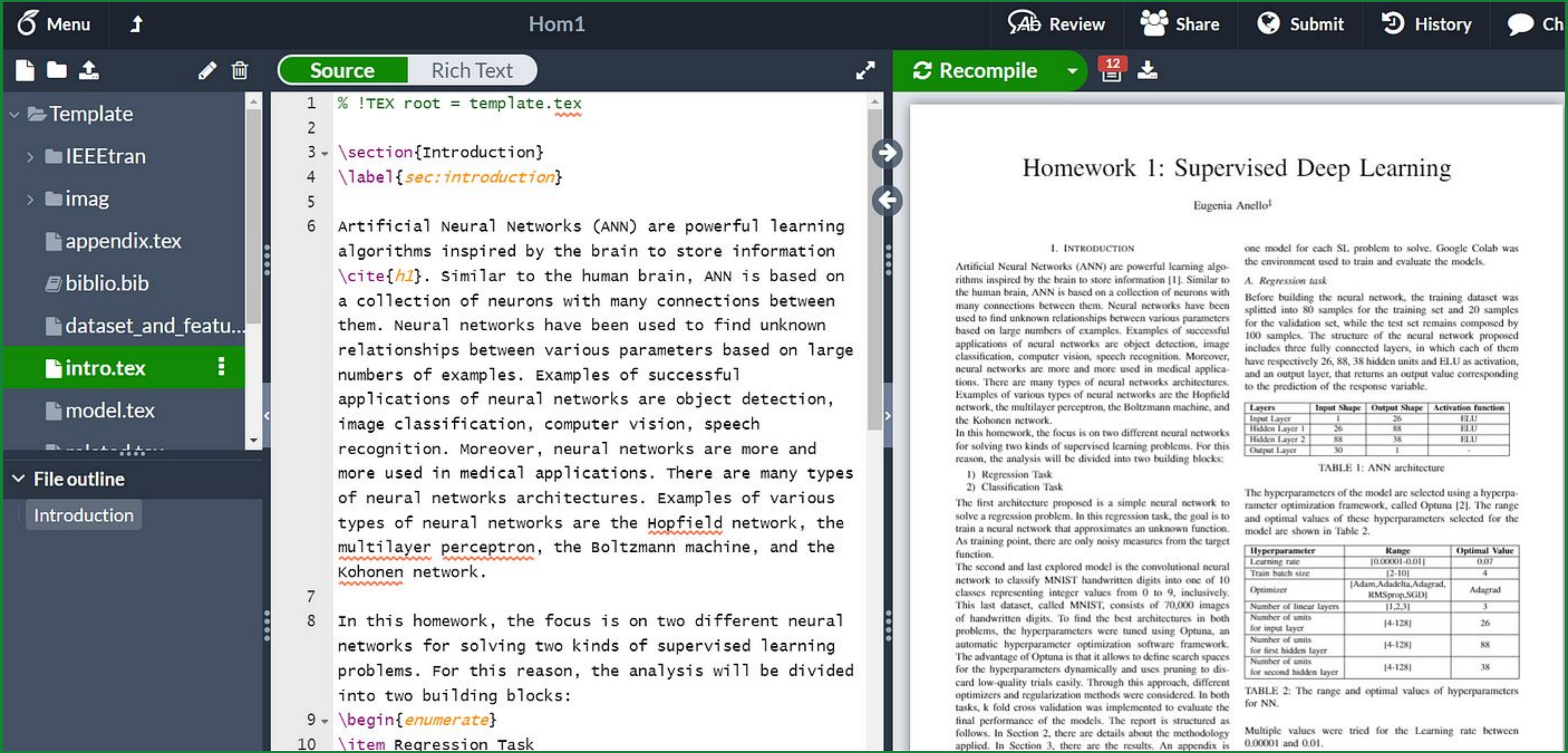
History
Chat
Source
Rich Text
Recompile
\section{Introduction} \label{sec:intro}
\latex\ \footnote{\url{http://www.latex-project.org/}} is a document markup
language that is particularly well suited for the publication of
mathematical and scientific articles \citep{lamport94}. \latex\ was written
in 1985 by Leslie Lamport who based it on the \TeX\ typesetting language
which itself was created by Donald E. Knuth in 1978. In 1988 a suite of
\latex\ macros were developed to investigate electronic submission and
publication of AAS Journal articles
\citep{1989BAAS...21..780H}. Shortly
afterwards, Chris Biemesdefer merged these macros and more into a \latex\
2.08 style file called \aastex. These early \aastex\ versions introduced
many common commands and practices that authors take for granted today.
Substantial revisions
were made by Lee Brotzman and Pierre Landau when the package was updated to
v4.0. AASTeX v5.0, written in 1995 by Arthur Ogawa, upgraded to \latex\ 2e
which uses the document class in lieu of a style file. Other improvements
to version 5 included hypertext support, landscape deluxetables and
improved figure support to facilitate electronic submission.
\aastex\ v5.2 was released in 2005 and introduced additional graphics
support plus new mark up to identifier astronomical objects,
Template AASTEX PASP Article with Examples: v6.3.1
ABSTRACT
1. INTRODUCTION
MacBook Pro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IEEEtran
imag
appendix.tex
biblio.bib
dataset_and_featu...
intro.tex
model.tex
File outline
Introduction
% !TEX root = template.tex
\section{Introduction}
\label{sec:introduction}
Artificial Neural Networks (ANN) are powerful learning algorithms inspired by the brain to store information \cite{h1}. Similar to the human brain, ANN is based on a collection of neurons with many connections between them. Neural networks have been used to find unknown relationships between various parameters based on large numbers of examples. Examples of successful applications of neural networks are object detection, image classification, computer vision, speech recognition. Moreover, neural networks are more and more used in medical applications. There are many types of neural networks architectures. Examples of various types of neural networks are the Hopfield network, the multilayer perceptron, the Boltzmann machine, and the Kohonen network.
In this homework, the focus is on two different neural networks for solving two kinds of supervised learning problems. For this reason, the analysis will be divided into two building blocks:
\begin{enumerate}
\item Regression Task
Homework 1: Supervised Deep Learning
Eugenia Anello
I. Introduction
A. Regression task
TABLE 1: ANN architecture
TABLE 2: The range and optimal values of hyperparameters for NN.

LaTeX Basics

LaTeX Basics

Document Structure:

- `\documentclass{article}`
- `\begin{document}`
- `\end{document}`

Packages: Extend functionality. Example: `\usepackage{amsmath}` for advanced math.

Comments: `%` for inline comments.

Writing Math in LaTeX

Inline Equations:

`\( a^2 + b^2 = c^2 \)`

Displayed Equations:

```
\begin{equation} E = mc^2
\end{equation}
```

Common Math Symbols:

`\frac`, `\sum`, `\int`, `\alpha`, `\pi`

Examples for Calculus:

derivatives, integrals, limits.

LaTeX Basics and Writing Math in LaTeX

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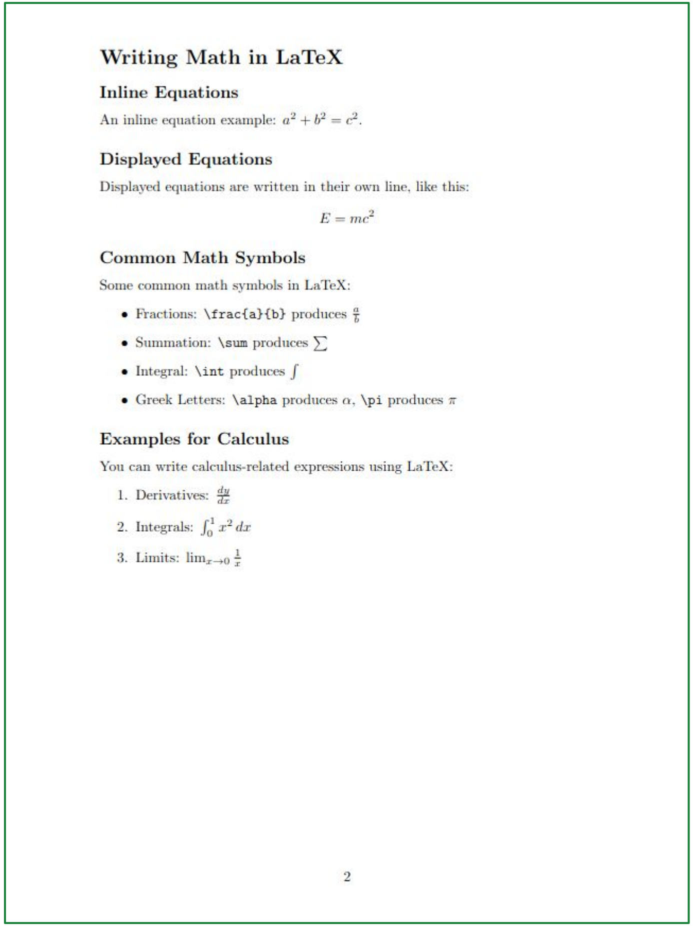


Writing Math in LaTeX

Inline Equations

An inline equation example: $a^2 + b^2 = c^2$.

Displayed Equations

Displayed equations are written in their own line, like this:

$$E = mc^2$$

Common Math Symbols

Some common math symbols in LaTeX:

- Fractions: `\frac{a}{b}` produces $\frac{a}{b}$
- Summation: `\sum` produces $\sum$
- Integral: `\int` produces $\int$
- Greek Letters: `\alpha` produces α, `\pi` produces π

Examples for Calculus

You can write calculus-related expressions using LaTeX:

1. Derivatives: $\frac{dy}{dx}$
2. Integrals: $\int_0^1 x^2 \, dx$
3. Limits: $\lim_{x \to 0} \frac{1}{x}$

2

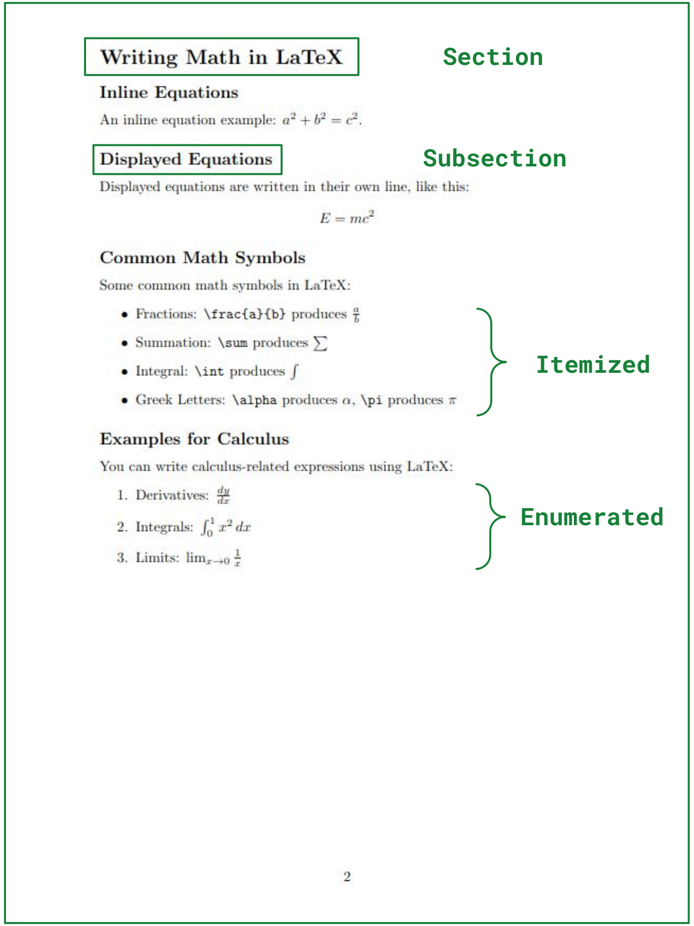
Structuring Your Document

- **Sections and Subsections**:
  - `\section{Introduction}`
  - `\subsection{Background}`
- **Lists**:
  - Itemized:

```
\begin{itemize}
        \item Fractions
\end{itemize}
```

  - Numbered:

```
\begin{enumerate}
        \item Derivatives
\end{enumerate}
```



Writing Math in LaTeX

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2

Including Figures and Tables

- **Figures**:
  - `\section{Introduction}`
  - `\subsection{Background}`
- **Tables**:
  - Itemized:

```
\begin{tabular}{|c|c|}
\hline Column 1 & Column 2 \\\hline
\end{tabular}
```

LaTeX Workshop: Figures, Tables, and Citations

Dalia Kamal Zadeh and Koorosh Komeili Zadeh

Including Figures and Tables

Figures

To include a figure in LaTeX, use the `figure` environment:

```
\begin{figure}
    \includegraphics{image.png}
    \caption{A sample figure}
\end{figure}
```

Example usage in the document:

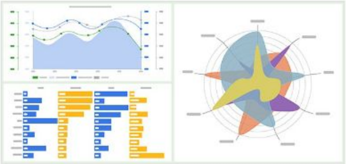


Figure 1: A sample figure

Tables

Tables in LaTeX are created using the `tabular` environment. You can create tables with various types of data, including text, numbers, and percentages, and even format them for readability.

```
\begin{tabular}{|c|c|c|c|}
    \hline
    Name & Age & Score & Improvement (\%) \\
    \hline
    Alice & 21 & 85 & 5.5 \\
    Bob & 22 & 90 & 7.2 \\
    Charlie & 20 & 78 & 4.1 \\
    Diana & 23 & 92 & 6.8 \\
    \hline
\end{tabular}
```

Here is how it looks:

Name	Age	Score	Improvement (%)
Alice	21	85	5.5
Bob	22	90	7.2
Charlie	20	78	4.1
Diana	23	92	6.8

Table 1: Sample table with fictional data

Tables can be customized further with more formatting options, colors, and styles.

Bibliography and Citations

- **Using BibTeX**:

  To automatically manage citations:

  `\bibliography{references}`

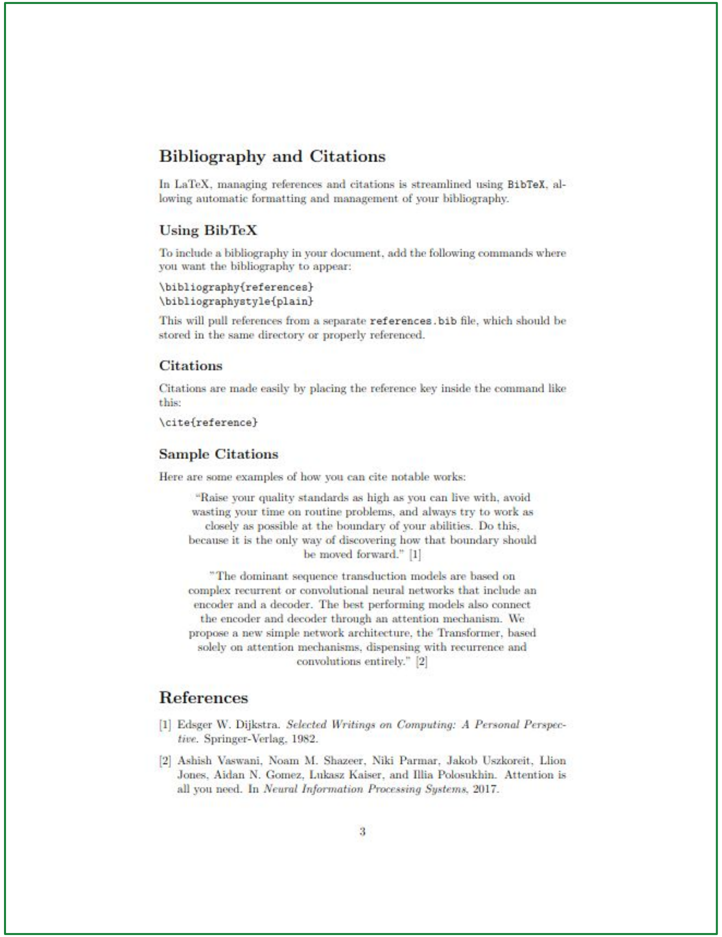
- **Citations**:

  For in-text citations: `\cite{reference}`

- **References list**:

  Manage reference details.

```
File: references.bib
@article{exampleReference,
  author = {Edsger W. Dijkstra},
  title = {Sample Paper},
  journal = {Journal of Examples},
  year = {2002}
}
```



Bibliography and Citations

In LaTeX, managing references and citations is streamlined using `BibTeX`, allowing automatic formatting and management of your bibliography.

Using BibTeX

To include a bibliography in your document, add the following commands where you want the bibliography to appear:

```
\bibliography{references}
\bibliographystyle{plain}
```

This will pull references from a separate `references.bib` file, which should be stored in the same directory or properly referenced.

Citations

Citations are made easily by placing the reference key inside the command like this:

```
\cite{reference}
```

Sample Citations

Here are some examples of how you can cite notable works:

> "Raise your quality standards as high as you can live with, avoid wasting your time on routine problems, and always try to work as closely as possible at the boundary of your abilities. Do this, because it is the only way of discovering how that boundary should be moved forward." [1]

> "The dominant sequence transduction models are based on complex recurrent or convolutional neural networks that include an encoder and a decoder. The best performing models also connect the encoder and decoder through an attention mechanism. We propose a new simple network architecture, the Transformer, based solely on attention mechanisms, dispensing with recurrence and convolutions entirely." [2]

References

[1] Edsger W. Dijkstra. *Selected Writings on Computing: A Personal Perspective*. Springer-Verlag, 1982.

[2] Ashish Vaswani, Noam M. Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Lukasz Kaiser, and Illia Polosukhin. Attention is all you need. In *Neural Information Processing Systems*, 2017.

Overleaf Advanced Features

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Tips for LaTeX

Practice: Start with simple documents and take a note via LaTeX.

Resources:

- LaTeX Wikibook
- Overleaf documentation.

Ask for Help: LaTeX communities or Language Models.

Hands-On Practice

Walk through creating a simple document together on Overleaf.

Write some math equations, insert an image, and create a table.

Final Questions & Feedback

Q&A Session

Feedback

Thanks

See you soon!