LaTeX Workshop for Research Paper Writing

Dr. Bindeshwar Singh Kushwaha

Ambalika Institute of Management and Technology, Lucknow

Workshop Overview

- Introduction to LaTeX
- Why Use LaTeXfor Research
- Basic Document Structure and Math Examples
- Installing MiKTeX, TeXStudio, GreenShot
- Sections and Research Paper Formatting
- Tables, Figures, and Images
- Citations and References
- Simple TikZ Diagrams
- Client–Server Architecture Example

What is LaTeX?

LaTeX is a powerful document preparation system used widely in research and academia.

- Helps create professional and structured documents
- Excellent for mathematics and scientific writing
- Automatically manages citations, references, numbering
- Produces high-quality, consistent PDF outputs
- Used by IEEE, Springer, Elsevier, universities, etc.

Why Use LaTeX for Research?

- Perfect for writing research papers, theses, and reports
- Supports complex equations:

$$E = mc^2$$

- Figures and tables look professional
- Automatic bibliography using BibTeX
- Fully open-source and free to use

Basic LaTeX Document Structure

1. `\documentclass{article}`
2. `\begin{document}`
3. Write content
4. `\end{document}`

Math Example in LaTeX

Inline Math: $a^2 + b^2 = c^2$

Displayed Equation:

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2}$$

Installing MiKTeX, TeXStudio, and GreenShot

1. **Install MiKTeX (LaTeX Distribution)**
   - Official Website: `https://miktex.org/download`
   - Download "Basic MiKTeX Installer"
   - Install for: **All Users**
   - Allow: **Install missing packages on-the-fly (Yes)**
   - After installation → Open MiKTeX Console → Click **Update**

2. **Install TeXStudio (LaTeX Editor)**
   - Official Website: `https://www.texstudio.org/`
   - Download Windows Installer
   - Install with default settings
   - TeXStudio automatically detects MiKTeX

3. **Install GreenShot (Screenshot Tool for LaTeX Projects)**
   - Official Website: `https://getgreenshot.org/downloads/`
   - Download the Windows version
   - Useful for capturing images for research papers
   - Helps take clean screenshots for inserting into LaTeX documents

Explaining Sections in LaTeX

Why Sections?

- To organize your research paper into logical parts
- To make the document structured and readable
- To automatically generate numbering
- To automatically appear in the Table of Contents

Section Commands:

- `\section{Main Heading}`
- `\subsection{Sub Heading}`
- `\subsubsection{Small Heading}`

Example Code

```
\section{Introduction}
\subsection{Problem Statement}
\subsubsection{Motivation}
```

Research Paper Format and Section Explanation

Standard Sections in a Research Paper:

- **Title** — Represents the core topic of your research.
- **Abstract** — A short summary of the entire paper (150–250 words).
- **Introduction** — Introduces the problem, background, and objectives.
- **Literature Review** — Discusses existing research and gaps.
- **Methodology** — Describes how the research was conducted (data, tools, process).
- **Results** — Presents findings, tables, and graphs.
- **Discussion** — Interprets results, importance, and implications.
- **Conclusion** — Summarizes contributions and future work.
- **References** — List of cited sources using BibTeX.

Table in LaTeX: Code, Output, Explanation

1. LaTeX Code for the Table:

```
\begin{tabular}{|c|c|c|}
 \hline
 A & B & C \\
 \hline
 1 & 2 & 3 \\
 \hline
 4 & 5 & 6 \\
 \hline
\end{tabular}
```

2. Output Table:

A	B	C
1	2	3
4	5	6

3. Explanation:

- `\begin{tabular}{|c|c|c|}` → 3 centered columns with borders
- `&` → separates cells

Mathematical Expressions (1/2)

1. **Inline Math:** $a^2 + b^2 = c^2$

2. **Display Math:**

$$E = mc^2$$

3. **Fraction:**

$$\frac{x+1}{x-1}$$

4. **Square Root:**

$$\sqrt{x}, \qquad \sqrt{a^2 + \sqrt{b}}$$

5. **Summation:**

$$\sum_{k=1}^{n} k = \frac{n(n+1)}{2}$$

Mathematical Expressions (2/2)

6. Integral:

$$\int_0^{\pi} \sin x \, dx = 2$$

7. Matrix:

$$\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$$

8. Numbered Equation:

$$F = ma \tag{1}$$

9. Limit:

$$\lim_{x \to 0} \frac{\sin x}{x} = 1$$

10. Greek Symbols:

$$\alpha, \beta, \gamma, \theta, \lambda, \mu, \pi, \sigma$$

Including Images in LaTeX

Basic Command:

- `\includegraphics[width=5cm]{image.png}`
- Images can be PNG, JPG, PDF
- Always place images in a folder (e.g., `images/`)

Example image displayed above.

Citations in LaTeX(Without .bib File)

Why Citations?

- To give credit to authors
- To avoid plagiarism
- To support your research paper
- To show the source of information

How to Cite Manually:

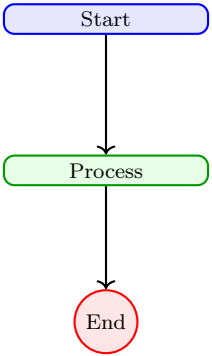
```
According to research \cite{lecun1998},
deep learning became widely recognized
after convolutional neural networks.
```

Manual Reference List (inside the document):

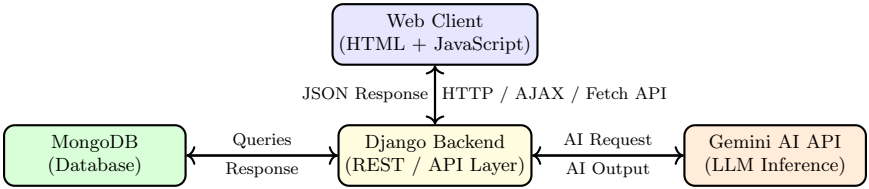
```
\begin{thebibliography}{9}

 \bibitem{lecun1998}
 Yann LeCun, Leon Bottou, Yoshua Bengio, and Patrick Haffner,
 "Gradient-Based Learning Applied to Document Recognition",
 Proceedings of the IEEE, 1998.
\end{thebibliography}
```

Simple TikZ Example



Client–Server Architecture Diagram



Thank You!

Questions and Discussion