LaTeX 的安装和使用

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什么是 LaTeX?

- TeX
  - 科学和艺术结合的产物
  - 计算机科学家 Donald.E.Knuth 设计并实现
  - 包含很多艺术家，设计师的功劳，如著名的书法家和字体设计师 Hermann Zapf
  - 宏包，字体，扩展软件成千上万，适合不同领域的需要

- LaTeX
  - 计算机科学家 Leslie Lamport 在 20 世纪 80 年代初期开发
  - 没有排版和程序设计的知识也可以发挥 TeX 的强大功能
  - 能在几天，甚至几小时内生成很多具有书籍质量的印刷品
  - 非常适用于生成高印刷质量的科技和数学类文档

LaTeX 排版示例

Formatting Instructions for Authors Using LaTeX

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Association for the Advancement of Artificial Intelligence
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Abstract

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- No type 3 fonts may be used (even in illustrations).
- Your title must follow US capitalization rules.
- LaTeX documents must use the Times or Nimbus font package (do not use Computer Modern for the text of your paper).
- No LaTeX 209 documents may be used or submitted.

图 1: 文档排版（1）

LaTeX 排版示例

Tu ne quaesieris, scire nefas, quem mihi, quem tibi finem di dederint, Leuconoe, nec Babylonios temptaris numeros. ut melius, quidquid erit, pati. seu pluris hiemes seu tribuit Iuppiter ultimam, quae nunc oppositis debilitat pumicibus mare Tyrrhenum: sapias, vina liques et spatio brevi spem longam reseces. dum loquimur, fugerit invida aetas: carpe diem quam minimum credula postero.
♡

图 2: 文档排版（2）

LaTeX 排版示例

PPT 排版示例

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2020 年 4 月 5 日

Convergence analysis

Theorem

Suppose that **A1**-**A2** *hold, the sequence* $(\mathbf{x}^{(t)}, \mathbf{y}^{(t)})$ *over* T *iterations is generated by Algorithm in which learning rates satisfy* $\beta < \gamma/(4(3L_y^2+2))$ *and* $\alpha \leqslant \min\{L_x, 1/(L_x/2 + 6L_x^2/(\gamma^2\beta) + 3\beta L_x^2/2)\}$. *Then, there exists constant* ζ' *(which is independent on parameters* μ, b, q, d *and* T*) so that when function* $f(\mathbf{x}, \mathbf{y})$ *is black-box w.r.t. both* $\mathbf{x}$ *and* $\mathbf{y}$, *the convergence rate of ZO-Min-Max is given by*[1]

$$\mathbb{E}\|\mathcal{G}(\mathbf{x}^{(t)}, \mathbf{y}^{(t)})\|^2 \leqslant \frac{c}{\zeta'}\frac{\mathcal{P}_1' - \mathcal{P}_T'}{T} + \frac{c\alpha}{\zeta'}\sigma_x^2 + \frac{cb_1 + d^2L_y^2\zeta'}{\zeta'}\mu^2 + \frac{cb_2 + 2\zeta'}{\zeta'}\sigma_y^2,$$

- Convergence rate: $O(1/T + 1/b + d/q)$(FO case: $O(1/T)$)
  - T: number of iterations
  - b: mini-batch size
  - d: number of optimization variables
  - q: number of random directions used in gradient estimators

[1] Proof and more details are in our paper

图 3: PPT 排版

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推荐配置

- TeX 部分
  - Texlive/CTeX，推荐前者（跨平台），不过安装时间较长
  - Texlive 官网：http://tug.org/texlive/acquire-netinstall.html
- LaTeX 编辑器
  - TeXworks, TeXstudio
  - 都差不太多，我个人用的是 TeXworks（比较简洁）
  - TeXworks 官网：http://www.tug.org/texworks/
- 临时测试或者协作文档可以使用在线平台 Overleaf
  - 无需安装，直接使用
  - https://www.overleaf.com/

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简单示例

```
\documentclass{article}% 文章类型
\usepackage{XeCJK}% 中文支持宏包
\begin{document}% 开始正文
你好！\\% “\\”是换行符
Hello!
\end{document}% 结束
```

你好！
Hello!

语法和一些注意点

- “\”后面接一条命令
- \begin{***} 和\end{***} 中间是特定的环境
- 第一行\documentclass{***} 确定文章的类型，然后\usepackage{***} 引入宏包
- 正文部分在\begin{document} 和\end{document} 之间
- 区分大小写，“%”后面是注释
- 编译引擎一般选 XeLaTeX 即可，纯英文的话pdfLatex会更快一些。

公式排版，分为行内公式和行间公式

```
% “$”间是行内公式
示例 $f(x)=x^2+2x+1$ 示例
\begin {equation}% 公式环境
\begin{aligned}% 对齐环境，需
\usepackage {amsmath}
x &= \int_0^yt^2dt\\
y &= \frac{\partial z}{\partial x}\\
% “&”控制对齐位置
\end{aligned}
\end{equation}
```

示例 $f(x)=x^2+2x+1$ 示例

$$\begin{aligned} x &= \int_0^y t^2 dt \\ y &= \frac{\partial z}{\partial x} \end{aligned} \tag{1}$$

图片排版

```
\begin{figure}% 图片环境
\includegraphics[width=5.3cm]{1.png}
\caption{示例图片（1）}% 加标题
\end{figure}
```

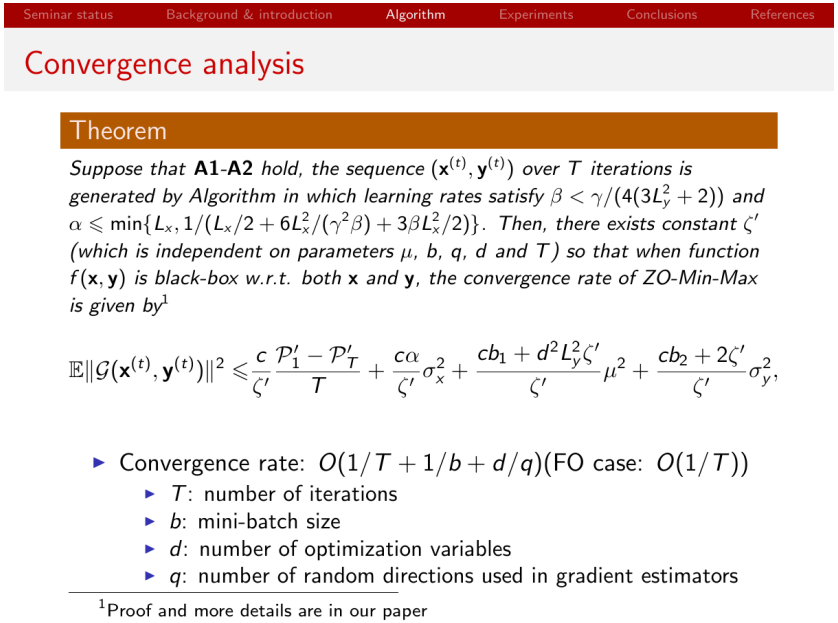

图 4: 示例图片（1）

图片排版

```
\begin{figure}[H]%H 表示位置固定
\centering
\subfigure{% 插入子图
\includegraphics[width=2.2cm]{4.pdf}}
\hspace{0.1in}% 控制图片间距离
\subfigure{
\includegraphics[width=2.2cm]{1.png}}
\caption{示例图片（2）}
\end{figure}
```

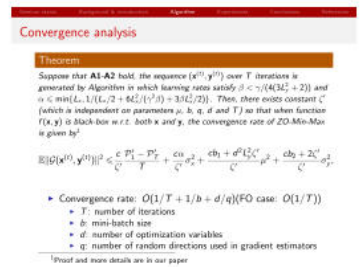

图 5: 示例图片（2）

表格排版

```
\begin{table}[H]% 创建一个区域
\centering% 居中
\caption{均值和方差的估计结果}
\begin{tabular}{ccc}% 主要部分
\hline% 加横线
& 均值估计量 & 方差估计量 \\
\hline
$X_{(1)}$ & 2.517E+00 & 2.039E-01 \\% “&”分隔单元格
$X_{(2)}$ & 2.148E+00 & 9.667E-02 \\% “$”间是数学环境
$X_{(3)}$ & 1.991E+00 & 8.665E-02 \\
\hline
\multicolumn{3}{c}{总结:$X_{(3)}$ 较好}% 合并单元格\\
\hline
\end{tabular}
\end{table}
```

表 1: 均值和方差的估计结果

	均值估计量	方差估计量
$X_{(1)}$	2.517E+00	2.039E-01
$X_{(2)}$	2.148E+00	9.667E-02
$X_{(3)}$	1.991E+00	8.665E-02
总结:$X_{(3)}$ 较好		

枚举

```
\begin{itemize}
\item 内容 1
\item 内容 2
\item 内容 3
\end{itemize}
```

- 内容 1
- 内容 2
- 内容 3

其它

- 章节相关：\section, \subsection, \subsubsection
- 目录生成：\tableofcontents
- 字体大小：\tiny, \scriptsize, \footnotesize, \small, \normalsize, \large, \Large, \LARGE, \huge, \Huge

总结和进阶技巧

- 公式排版：比 word 功能强大、方便、好看，Mathpix Snipping Tool 可以把有公式的图片转成代码，方便文章之间公式的迁移；
  http://www.hostmath.com/可以实现图形化输入转代码
- 图片排版：很方便，加入更多参数可以精细控制大小、位置
- 表格排版：手动输入可能有点麻烦，但是可以在 excel 中使用 excel2latex 宏转成代码，https://github.com/krlmlr/Excel2LaTeX
- 其它功能：枚举，章节和目录的生成，字体的调整

Thanks!

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[1] https://docs.huihoo.com/homepage/shredderyin/tex_frame.html
[2] https://stu.cs.tsinghua.edu.cn/ harry/latex-talk.pdf
[3] https://baike.baidu.com/item/LaTeX/1212106?fr=aladdin
[4] https://blog.csdn.net/jkxsanger/article/details/7217999