如何用LaTeX排版论文

张超@CSLT, RIIT, Tsinghua University

缘起

- 高德纳（Donald E Knuth, 1938 ~ ）
  - 计算机界鼻祖，巨牛
  - 一个风趣的人
  - 中文名字的由来

- The Art of Computer Programming
  - 二十世纪12部最佳学术专著之一
  - 高德纳毕生最重要的事业
  - 已出版7卷中的3卷

缘起

- TEX的诞生
  - TAOCP卷二第二版的排版令人失望
  - 1977年高德纳编写计算机排版软件以使TAOCP免受出版业衰退的影响

- TEX和METAFONT
  - TEX (/tek/，希腊语科学、艺术)
  - METAFONT为TEX配套造字软件
  - 高德纳自己完成所有代码
  - 版本号π(3.141592)和e(2.71828)
  - 发现bug的指数级报酬、最终版本号

缘起

- TeX 和 LaTeX
  - TeX 由700条初始命令控制⋯⋯ ☹
  - 利用 TeX 宏定义功能开发易用的宏库
    - $\mathcal{AMS}$-TeX: $\mathcal{AMS}$专用软件，强大的公式排版能力
    - LaTeX (by Lesile Lamport): 易学习，且有交叉引用功能
  - LaTeX 2_ε 的流行
    - 大量 LaTeX 爱好者自发编写的宏包，重复、混乱
    - 统一并重写LaTeX的项目，LaTeX3 (by Frank Mittelbach)
    - LaTeX3项目耗时长久，故先公布中间版本LaTeX 2_ε

Why LaTeX

- 只需关注内容本身而无需关注显示细节
  - 指定显示内容和排版建议，程序控制细节
  - 脚注等
  - 单双栏混排(当双栏文档包含超长图表时)

- 自动管理文档元素
  - 使用标号管理：图表、公式、章节号
  - 交叉引用
    - 引文库的维护、复用、自动排版
    - 文档内标号的引用

Why LaTeX

○ 更好的排版

by Word

nearest to an input frame. A dynamic output distribution is thus built to compute the observation likelihood for that frame during decoding. DGMS is explained formally as follows.

Let $N_m = \mathbf{N}(\mu_m; \Sigma_m)$ denote the m-th Gaussian mixture, $b_r(\mathbf{o}) = \sum_{m=1}^{M} w_m \, \mathbf{N}(\mathbf{o}|\mu_m; \Sigma_m)$ the output density for the reconstructed state, r, $N'_1, \ldots, N'_k$ the k Gaussian components

by LaTeX

to an input frame. A dynamic output distribution is thus built to compute the observation likelihood for that frame during decoding. DGMS is explained formally as follows.

Let $N_m = \mathbf{N}(\mu_m; \Sigma_m)$ denote the m-th Gaussian mixture, $b_r(\mathbf{o}) = \sum_{m=1}^{M} w_m N(\mathbf{o}|\mu_m; \Sigma_m)$ the output density for the reconstructed state, r, $N'_1, \ldots, N'_k$ the k Gaussian components nearest to

○ 整体最优排版

○ 考虑文档色彩进行排版

○ 自动添加连词符

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Why L^AT_EX

- 更美观、更易输入的公式

  by Word   by L^AT_EX

  $$\begin{cases} b'(\mathbf{o}) = \sum_{m=1}^{k} c_m'' \, \mathrm{N}(\mathbf{o}; \mu_m'; \Sigma_m') \\ c_m'' = \dfrac{c_m'}{\sum_{m=1}^{k} c_m'} \end{cases}.$$

  $$\begin{cases} b'(\mathbf{o}) = \sum_{m=1}^{k} c_m'' N(\mathbf{o}; \mu_m'; \Sigma_m') \\ c_m'' = \dfrac{c_m'}{\sum_{m=1}^{k} c_m'} \end{cases}.$$

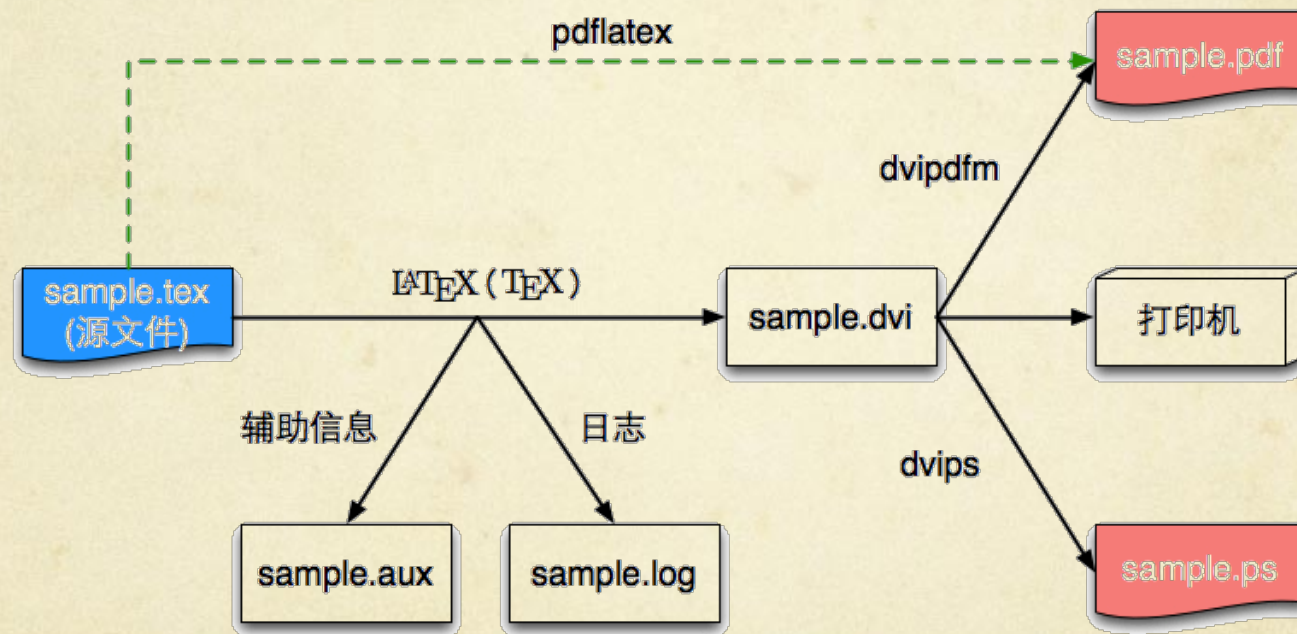 - 最规范的数学公式、符号($\mathcal{AMS}$)

- 更强大的元素控制
  - 利用METAFONT控制贝塞尔曲线可随意生成字符

- 更广泛的应用整合(简历、PPT、棋谱、乐谱等)

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How LATEX works

○ LATEX工作流程图

   ○ pdflatex sample.tex ↵

How LATEX works

- 递归的文档元素定义
  - 盒子
  - 对排版进行整体优化

页面盒子	
页眉页脚盒子	
主体盒子	
段落盒子	
句子盒子	
弹性距离	
词盒子	LaTeX
字符盒子	
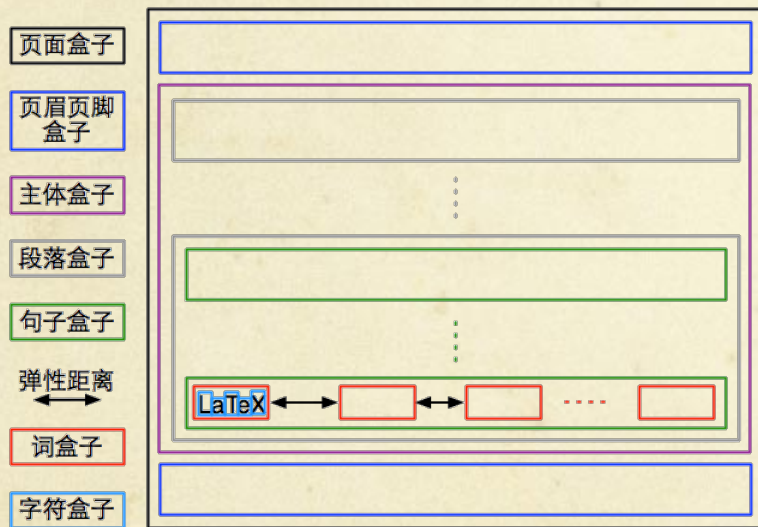
- 盒子的继承和多态
  - 继承：基类

- 多态
  - 左右盒子
  - 段落盒子
  - 标尺盒子

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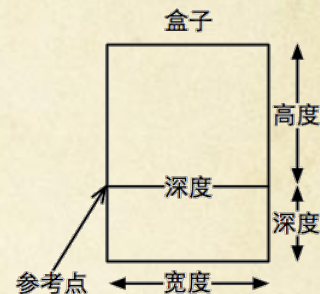
How LATEX works

- 非所见即所得(WYSIWYG)
  - 根据混合命令和内容的源文件生成排版好的文件
  - 原因：考虑色彩的2遍排版(交叉引用需4遍排版)
  - 合理性
    - 不存在完全意义上的所见即所得(差异总存在)
    - 排版效果远胜1遍排版
  - 一些可视化的改善工作
    - Emacs + AutoTeX：公式等部分内容的所见即所得

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排版科技论文

- LaTeX 的安装
  - 推荐使用已整合中文支持及其它常用宏包的CTeX (http://www.ctex.org)安装包
    - http://ftp.ctex.org/pub/tex/systems/ctex/2.9/CTeX_2.9.2.164_Full.exe
  - 其它LaTeX安装包：TeXLive ...

- 常用的LaTeX编辑器
  - Emacs, VIM, TextMate, WinEdt ...
  - 支持一键编译生成PDF文件

排版科技论文

○ 排版文档流程类似C++编程[*类比*]

○ 以排版ASRU会议论文为例
  ○ 目标：编写sample.tex文件[*sample.cpp*]
  ○ 同一目录下放置ASRU会议提供的模板文件
    ○ IEEEtran.cls：论文正文样式模板（或ICASSP会议提供的spconf.sty文件，引用方式略有不同）
    ○ IEEEbib.bst：参考文献样式模板
  ○ →样式、资源、内容三者分离，便于管理、复用

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排版科技论文

○ 文件引用外部文件[*#include*]

  ○ \documentclass{...} \usepackage{...} (命令格式：\cmd)

ASRU: IEEEtran.cls

```
% IEEE Paper Template for US-LETTER Page Size (V1)
% Sample Conference Paper using IEEE LaTeX style file for
US-LETTER pagesize.
% Copyright (C) 2006-2008 Causal Productions Pty Ltd.
% Permission is granted to distribute and revise this file
provided that
% this header remains intact.
%
\documentclass[conference,letterpaper]{IEEEtran}
\usepackage{amsmath}
```

ICASSP: spconf.sty

```
% Template for ICASSP-2012 paper; to be used with:
%         spconf.sty  - ICASSP/ICIP LaTeX style file, and
%         IEEEbib.bst - IEEE bibliography style file.
%
-----------------------------------------------------------
-----------
\documentclass{article}
\usepackage{spconf}
\usepackage{amsmath}
```

$\mathcal{AMS}$ 数学公式样式包

  ○ 字符转义：\$, \%...

  ○ 行注释：% (*//*)

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排版科技论文

- 标题和作者信息
  - 标题：\title{...}
  - 作者信息

ASRU

模板预定义作者格式 →

```
\title{Detection-Based Accented Speech Recognition Using
Articulatory Features}

\author{
{Chao Zhang, Yi Liu}
```

临时变更字体大小，并加斜 →

```
\vspace{1.6mm}\\
\fontsize{10}{10}\selectfont\itshape
Center for Speech and Language Technologies, Tsinghua
University, Beijing, China
}
```

ICASSP

```
\title{Detection-Based Accented Speech Recognition Using
Articulatory Features}

\name{Chao Zhang$^{\star}$, Yi Liu$^{\dagger}$}
\address{$^{\star}$Center for Speech and Language Technologies,
Tsinghua University, Beijing, China}
```

↳ 模板预定义作者地址格式

  - 作者区分标号：\star, \dagger ... (遵循IEEE规定)
  - 仅为标题页样式内容的预定义(未正式排版)

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排版科技论文

- 文档主体
  - 主体的起止：\begin{document} ... \end{document}
  - 换行：\\, \newline (直接↵换行会被忽略)
  - 开始新的一段：↵↵
  - 空格：~,空格符(多个连续空格符仅相当于1个空格)

- 放置标题（页）
  - 放置在指定位置并排版：\maketitle

- 摘要
  - \begin{abstrct} ... \end{abstract}

- 关键词
  - \begin{keywords} ... \end{keywords}

```
\begin{document}

\maketitle

\begin{abstract}
We propose an attribute-based approach to accented speech
recognition.
\end{abstract}

\begin{keywords}
Accent, ASAT, Mickey Mouse
\end{keywords}
```

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排版科技论文

- 正文内容
  - 直接写在文档主体中，可插入引用、图表、公式等

- 章节标题
  - 带编号3级标题: \section{...}, \subsection{...}, \subsubsection{...}
  - 无编号标题: \section*{...}
  - 元素标号，可排印章节目录 \tableofcontents

文档元素标号 →

```
\section{Introduction}
\label{sec:intro}
Most state-of-the-art automatic speech recognition (ASR)
systems fail to perform well when the speaker has a regional
accent.

\subsection{ASAT Approach}
ASAT is a new speech recognition paradigm. If you want to know
the motivation of ASAT, please refer to Section~\ref{sec:intro}
\subsubsection{Detectors}
Detectors is a crucial part of the ASAT system.
\subsubsection{Mergers}
Merger integrates all the detected evidences.

\subsection{Accented Mandarin}
```

在文档中引用已标号元素 →

1. INTRODUCTION

Most state-of-the-art automatic speech recognition (ASR) systems fail to perform well when the speaker has a regional accent.

1.1. ASAT Approach

ASAT is a new speech recognition paradigm. If you want to know the motivation of ASAT, please refer to Section 1

1.1.1. Detectors

Detectors is a crucial part of the ASAT system.

1.1.2. Mergers

Merger integrates all the detected evidences.

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排版科技论文

- 浮动体
  - 因不可分割而在排版时有可能浮动到作者指定位置外排印的整体素材(图、表)
  - 图
    - 进入浮动体环境: \begin{figure}[...] ... \end{figure}
      - 设置浮动体位置: h, t, b
    - 引入图片: \includegraphics[...]{...} 支持图片类型: eps, jpg, png等

图片宽度为2.8in，
图片名称为figure1

图片居中 ⟶
图片注释 ⟶
图片标号 ⟶

```
\begin{figure}[!h]
    \centering
    \includegraphics[width=2.8in] {figure1}
    \caption{I am the caption of this figure.}
    \label{figure1}
\end{figure}
```

  - 排印图目录: \listoffigures

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排版科技论文

- 浮动体(续)
  - 表
    - 表格列对齐方式: l, c, r; 表格列线: |; 列元素分隔: &
    - 表格横线: 两行间 \hline, \cline{1-x}
    - 表内换行: \tabincell{...}{...} `\newcommand{\tabincell}[2]{\begin{tabular}{@{}#1@{}}#2\end{tabular}}`
    - 两栏文本中排印超过列宽表格: \begin{table*} ... \end{table*}
  - 多行 \usepackage{multirow}; 排印表目录: \listoftables

各列文字的对齐方式　每列用单线分隔

两行无分隔线
两列无分隔线
部分列划线
双线表

```
\begin{table}[t]
\caption{I am the caption of this table}
\label{table1}
\begin{tabular}{|l|c|c|}
 \hline
 \multirow{2}{*}{\bfseries System} &
\multicolumn{2}{|c|}{\bfseries {Syllable Error Rate (SER)\%}}\\
 \cline{2-3}
   & \bfseries TestP & \bfseries TestC \\
 \hline
 \hline
 Putonghua HMMs & 22.48 & 56.57 \\
 \hline
 Our System & 0.00 & 0.00 \\
 \hline
\end{tabular}
\end{table}
```

字体加粗

Table 1. I am the caption of this table

System	Syllable Error Rate (SER)%	
	TestP	TestC
Putonghua HMMs	22.48	56.57
Our System	0.00	0.00

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排版科技论文

- 公式
  - 独立成行的公式
    - \begin{equation} ... \end{equation}
    - 自动公式编号

```
\begin{equation}
    \label{equation1}
    y=\frac{1}{\sqrt{1+x^2}}
\end{equation}
```

$$y = \frac{1}{\sqrt{1+x^2}} \qquad (1)$$

  - 多行公式首对齐: 每公式起始加&
  - 公式组

公式中嵌入文字

公式组

```
\begin{equation*}
    \label{equation2}
    s(y,\vec{x},t)=
    \begin{cases}
        1,~\text{if }y_t=\text{`er' and palatal}(x_t)=true\\
        0,~\text{otherwise}
    \end{cases}
    .
\end{equation*}
```

无编号公式

$$s(y,\vec{x},t) = \begin{cases} 1, & \text{if } y_t = \text{`er' and palatal}(x_t) = true \\ 0, & \text{otherwise} \end{cases}$$

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排版科技论文

- 公式（续）
  - 嵌入行内的公式
    - $...$

```
$N^{'}_{1},\ldots,N^{'}_{k}$ the $k$ Gaussian components nearest
to speech frame $\mathbf{o}$ in terms of Mahalanobis distance,
and the dynamical output distribution is evaluated as follows.
```

$N'_1, \ldots, N'_k$ the k Gaussian components nearest to speech frame **o** in terms of Mahalanobis distance, and the dynamical output distribution is evaluated as follows.

- 枚举
  - 嵌入行内的公式
    - \usepackage{enumerate}
    - \begin{enumerate} ... \end{enumerate}

指定编号为"1."，默认为"(1)"

```
\begin{enumerate}[1.~]
\item Acquire canonical transcriptions with time.
\item Obtain alternative transcriptions.
\item Generate reliable accent specific unit candidates.
\item Select reliable accent specific units.
\end{enumerate}
```

1. Acquire canonical transcriptions with time.
2. Obtain alternative transcriptions.
3. Generate reliable accent specific unit candidates.
4. Select reliable accent specific units.

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排版科技论文

- 程序代码
  - 自动缩进并高亮代码
  - \usepackage{listings, xcolor}

```
\lstset{language=[ASM]Assembler,keywordstyle={\color{blue}},keyw
ordstyle=[2]{\color{magenta}},keywordstyle=[3]{\color{red}}}
\begin{lstlisting}
START:
    MOV AX, DATA
    MOV DS, AX
    MOV AX, EXTRA
    MOV ES, AX
    MOV CX, 30
    MOV DI, 0
\end{lstlisting}
```

```
START:
    MOV    AX, DATA
    MOV    DS, AX
    MOV    AX, EXTRA
    MOV    ES, AX
    MOV    CX, 30
    MOV    DI, 0
```

- 脚注
  - 排印脚注 \footnote{...}；引用脚注 \thefootnote{...}
  - 修改标号样式：\STYLE= \arabic, \roman, \Roman, \alpha, \Alpha, \fnsymbol

```
\renewcommand{\thefootnote}{\STYLE{footnote}}
```

排版科技论文

- 参考文献
  - 同目录下编写/维护文件sample.bib（参考文献库）
    - 文献库同引用、样式独立，可复用

```
@article{chlee_1994,
  author    = "J.-L. Gauvain and C.-H. Lee",
  title     = "Maximum a Posteriori Estimation for
Multivariate {G}aussian Mixture Observations of {M}arkov
Chains",
  journal   = "IEEE Transactions on Speech and Audio
Processing",
  volume    = "2",
  month     = apr,
  year      = "1994",
  pages     = "291-298"
}
```

强制字符大写

[7] J.-L. Gauvain and C.-H. Lee, "Maximum a posteriori estimation for multivariate Gaussian mixture observations of Markov chains," *IEEE Transactions on Speech and Audio Processing*, vol. 2, pp. 291–298, Apr. 1994.

[8] C. J. Leggetter and P. C. Woodland, "Maximum likelihood linear regression for speaker adaptation of continuous density hidden Markov models," *Computer Speech Language*, vol. 9, pp. 171–185, Apr. 1995.

- 在sample.tex文档中进行引用

```
Maximum a posteriori (MAP) \cite{chlee_1994} and maximum
likelihood linear regression (MLLR) \cite{woodland_1995} are
always applied to adapt the standard models.
```

Maximum a posteriori (MAP) [7] and maximum likelihood linear regression (MLLR) [8] are always applied to adapt the standard models.

- 在sample.tex文档中排印引用的文献；设定文献样式为IEEEbib.bst

```
\bibliographystyle{IEEEbib}
\bibliography{sample}

\end{document}
```

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排版科技论文

○ 参考文献（续）

  ○ 先运行bibtex排印文献，再编译两次sample.tex

  ○ 连续编号文献的排序、合并

    ○ \usepackage{natbib}

```
\usepackage[numbers,sort&compress]{natbib}
```

```
Conventional methods handle impact of accent by focusing on
pronunciation modelling for acoustic or phonetic accent changes
at different levels \cite{ghding_2008,kim_2009,saraclar_2000}.
```

Conventional methods handle impact of accent by focusing on pronunciation modelling for acoustic or phonetic accent changes at different levels [4–6].

排版科技论文

- 生成sample.pdf ☺
  - 点击编辑软件的pdflatex编译按钮
  - pdflatex sample.tex ⏎

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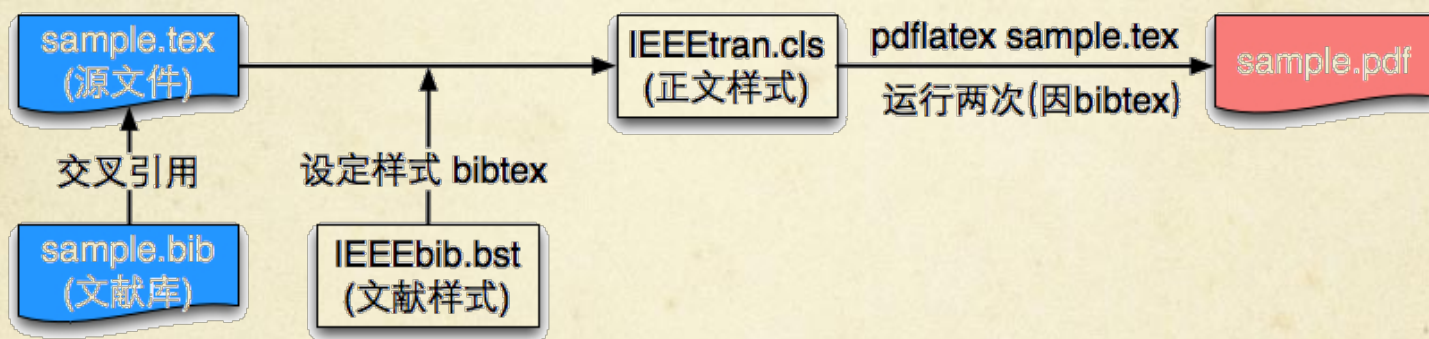
其它

- 中文支持
  - 正文内 \begin{CJK*}{GBK}{song} ... \end{CJK*}
  - \CJKtilde, \CJKindent

- 用 LaTeX 排版学位论文
  - 学位论文复杂，编写时间长，使用LaTeX效率更高
  - 使用THUThesis清华大学论文模板组
    - 目前包括本科综合论文训练、硕士论文、博士论文
    - https://github.com/xueruini/thuthesis
    - http://www.bakoma-tex.com/doc/latex/thuthesis/example/main.pdf

同Word的比较

- 优势
  - 程序稳定
  - 公式美观、输入公式容易
  - 参考文献维护简单、文献库可以复用
  - 无需关注排版需求，全部交由程序自动解决，且排版美观
  - 长表格、复杂元素等的排版容易

- 劣势
  - 不能立时见到编写结果
  - 不方便进行批注、修改
    - 建议Submission使用Word，Camera-Ready使用LaTeX
  - 表格的排版繁琐
  - 复杂，学习周期较长

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文献和资源

- l-short
  - 最好的 $\mathrm{\LaTeX\,2_\varepsilon}$ 入门教程(93分钟学会 $\mathrm{\LaTeX\,2_\varepsilon}$)
  - http://www.cfsm.cn/info/lshort-cn.pdf

- Mathsymb
  - 常用数学公式、符号表
  - http://amath.colorado.edu/documentation/LaTeX/Symbols.pdf

- Mathmode
  - 详尽的公式功能介绍
  - http://ftp.cs.pu.edu.tw/pub/CTAN/info/math/voss/mathmode/Mathmode.pdf

- http://www.ctex.org/HomePage

Thank for your listening~