國立交通大學

電子研究所

碩士論文

毫米波頻帶之單一使用者多輸入多輸出混合式預編碼與結合器設計

Design of mmWave Hybrid Precoder and Combiner for SU-MIMO Systems

研　究　生：李財華

指 導 教 授：周世傑 教授

：劉志尉 教授

中華民國一〇八年十一月

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研究生： 李財華　　Student： Tsai Hua Lee

指導教授： 周世傑　　Advisor： Shyh-Jye Jou

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A Thesis

Submitted to Institute of Electronics

College of Electrical and Computer Engineering

National Chiao Tung University

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Master of Science in Electronics Engineering

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摘要

在大 AI、ML 時代，自己寫論文已經不再是個有效率的做法，因此我們提出了一套基於卷積神經網路的論文自動生成技術。

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Student： Tsai-Hua Lee Advisor： Dr. Shyh-Jye Jou, Dr. Chih-Wei Liu

Institute of Electronics

National Chiao Tung University

Abstract

The following is a random text generated with the package lipsum. Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

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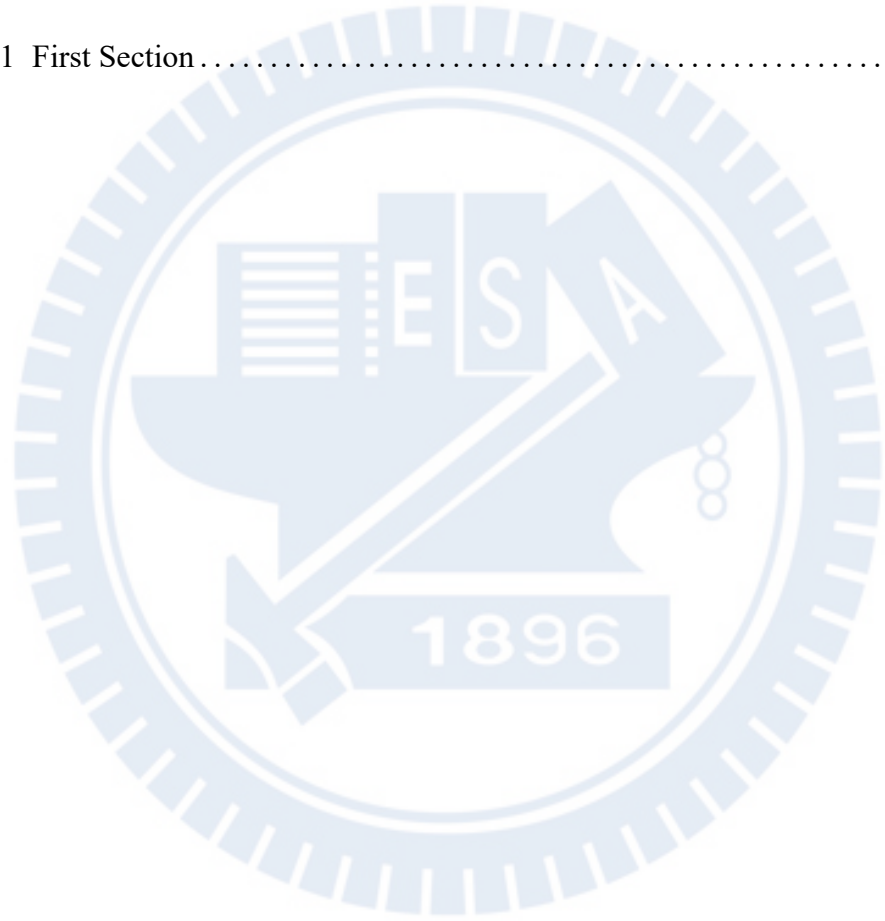
velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetuer.

Acknowledgments

I would like to thanks Dr Ren ... The following text is randomly generated. Nulla malesuada porttitor diam. Donec felis erat, congue non, volutpat at, tincidunt tristique, libero. Vivamus viverra fermentum felis. Donec nonummy pellentesque ante. Phasellus adipiscing semper elit. Proin fermentum massa ac quam. Sed diam turpis, molestie vitae, placerat a, molestie nec, leo. Maecenas lacinia. Nam ipsum ligula, eleifend at, accumsan nec, suscipit a, ipsum. Morbi blandit ligula feugiat magna. Nunc eleifend consequat lorem. Sed lacinia nulla vitae enim. Pellentesque tincidunt purus vel magna. Integer non enim. Praesent euismod nunc eu purus. Donec bibendum quam in tellus. Nullam cursus pulvinar lectus. Donec et mi. Nam vulputate metus eu enim. Vestibulum pellentesque felis eu massa.

Contents



List of Figures

List of Tables

Chapter 1

Introduction-How to run this latex template

1.1 Required Software

This template was generated with Windows, Linux users might need to double check

- Install MikTex Console
- Install a Tex Editor (TexStudio or the editor of your preference). In this quick tutorial I assume you use TexStudio.

1.2 Settings in MiKTeX console

Before running. Open MikTeX console, and uncheck box shown as follow to make sure MiKTeX console can download packages as required in your document.

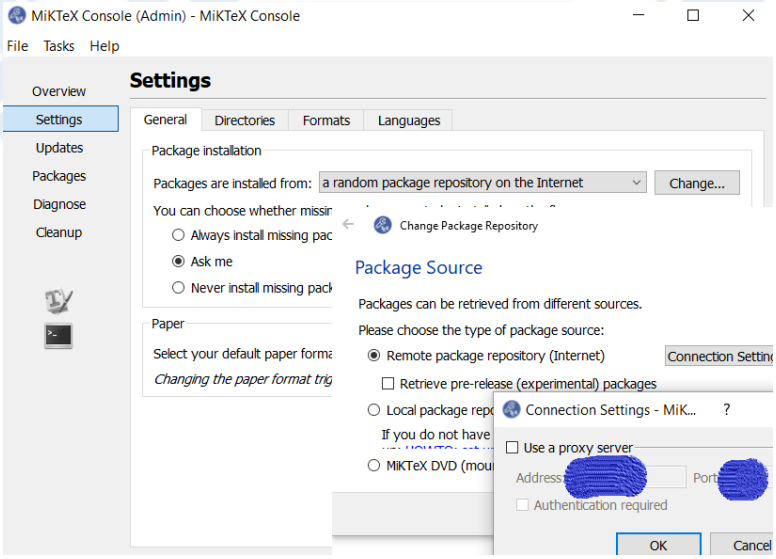


Figure 1.1: Uncheck **Use proxy server** in MiKTeX console

Then check for **Updates** and Install updates in MiKTeX console. Check **Always install missing packages** or **Ask me**

1.3 Settings in you editor

Open ***ThesisTemplate.tex*** with TexStudio.

This template uses the package xeCJK to type chinese characters. This package is not supported with the default compiler PdfLaTeX. Therefor, you need to change your settings to XeLaTeX in your editor. The settings for TexStudio are as follows.

Under Options->Configure TexStudio->Build

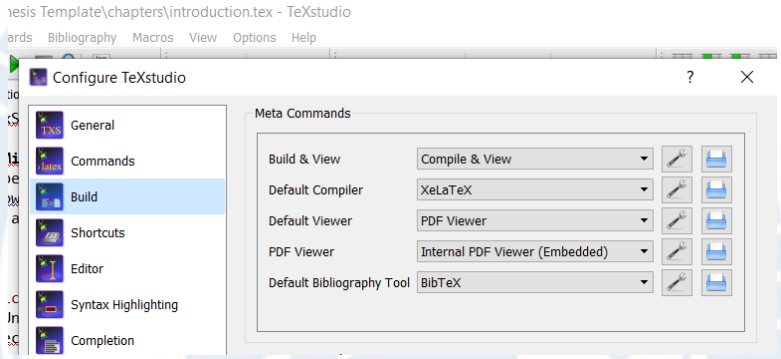


Figure 1.2: Set **XeLaTeX** as default compiler

With all the above settings, if you selected **Ask me** in MiKTeX console, then the first time you compile TexStudio will as Ask you to install missing packages. Just click Install.

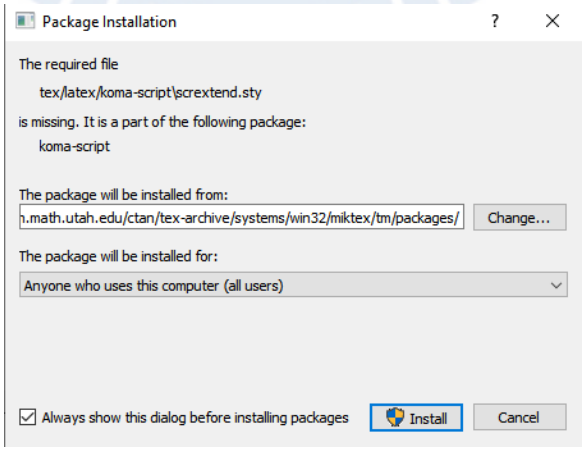


Figure 1.3: TexStudio will automatically select the repository from where the missing package will be downloaded and installed

Chapter 2

Background

Here is the background.

Figure 2.1: The Brave Monkey

Chapter 3

Design

Here is the design.

3.1 Feature Extraction

3.2 Thesis Modeling

3.3 Thesis Generation

Other style for algorithms, it needs package algorithm. Currently it is in conflict with the package algorithm2e

The following is a equation example. There are many ways you can do it.

$$\underbrace{P(y_i = x|E)}_{\text{yourtext}} = \frac{1}{P(E)} \underbrace{P(E|y_i = x)}_{\text{extr}} \underbrace{P(y_i = x)}_{\text{intr}}, \tag{3.1}$$

Equation without number

$$P_E^p(y_i = x) = P(y_i = x|E).$$

$$z^n = \frac{x}{y}. \tag{3.2}$$

Chapter 4

Evaluation

Here is the evaluation.

4.1 Datasets

4.2 Experiment Design

4.3 Experimental Results

4.3.1 Training Time

Table 4.1 lists the training time of different datasets.

Table 4.1: Training Time

Dataset	Training Time
A	1 hour
B	2 hours
C	3 hours
D	4 hours
E	5 hours

4.3.2 Example of Generated Thesis

Chapter 5

How to use citations

Here are the related works [1–4] and [8].

Chapter 6

One way to write algorithms

Algorithm 1: Name of the Algorithm

Input: Codeword from channel with the ith element equal to $L(P_{V_i}^{int})$

Output: Decoded message $\hat{V}$ with the ith element equal to $\hat{V}_i$

```
// Just comment this comment and the above Input and Output if not needed them
```

Initialization:

for *each* V_i *in* $\mathcal{V}$ **do**

    $V_i = L(P_{v_i}^{int})$

Decoding:

for *t = 1,..,Max Iterations* **do**

    for *m = 1,..,Sub Iterations* **do**

        Check Node Processing:

        do something based on Eqn. (3.1)

        Variable Node Processing:

        Calculate γ based on Eqn. (3.2)

        Check fo rearly termination or continue util max iter

Chapter 7

Conclusion

You have compled your thesis, do whatever you please with your life.

Appendix A

First Appendix

The is an appendix chapter. You can define more appendices in the same way.

A.1 First Section

The is an appendix session. You can define more sessions in the same way.

Reference

[1] R. G. Gallager, “Low-density parity check codes,” *IRE Trans. on Information Theory,* vol. IT-8, pp.21-28, Jan. 1962.

[2] D. J. C. Mackay, “Good error correcting codes based on very sparse matrices,” IEEE Trans. on Inform. Theory, vol. 45, pp.399-43I, Mar.1999.

[3] *IEEE Standard for Information Technology －Telecommunications and Information Exchange between Systems－Local and Metropolitan Area Networks－Specific Requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications,* IEEE Std. 802.3an, Sep. 2006.

[4] *Part 15.3:WirelessMedium Access Control (MAC) and Physical Layer (PHY) Specifications for High Rate Wireless Personal Area Networks(WPANs),* IEEE Std. P802.15.3c, 2009.

[5] *PHY/MAC Complete Proposal Specification, Std. IEEE 802.11-10/0433r,* IEEE 802.11 Task Group AD, May 2010.

[6] *P802.11ay™/D3.0 Draft Standard for Information Technology －Telecommunications and Information Exchange Between Systems－Local and Metropolitan Area Networks－Specific Requirements－Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications－Amendment 2: Enhanced throughput for operation in license-exempt bands above 45 GHz,* February, 2019.

[7] A. J. Blanksby and C. J. Howland, “A 690-mW1-Gb/s 1024-b, rate-1/2 low-density parity-check code decoder,” *IEEE J. Solid-State Circuits,* vol. 37, no. 3, pp. 404–412, Mar. 2002.

[8] M. P. C. Fossorier, M. Mihaljevic and H. Imai, “Reduced complexity iterative decoding of low-density parity check codes based on belief propagation,” *in IEEE Transactions on Communications,* vol. 47, no. 5, pp. 673-680, May 1999.

[9] whoever and whatever you put here