

國立陽明交通大學  
資訊管理與財務金融學系財務金融碩士班  
碩士論文

Graduate Program of Finance, Department of Information Management and  
Finance

National Yang Ming Chiao Tung University  
Master Thesis

圖神經網絡在股票投資組合優化中的應用：以產業關  
係與市場互動為基礎

Application of Graph Neural Networks in Stock Portfolio  
Optimization: Incorporating Industry Relations and Market  
Interactions

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中華民國 一一五年六月

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Portfolio Optimization: Incorporating Industry

Relations and Market Interactions

國立陽明交通大學

資訊管理與財務金融學系財務金融碩士班

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in

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# 誌 謝

謝天謝地

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國立陽明交通大學 資訊管理與財務金融學系財務金融碩士班

中華民國 一一五年六月



# 圖神經網絡在股票投資組合優化中的應用：以產業關係與市場互動為基礎

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## 摘要

中文摘要就從這邊開始寫。

本研究採用圖注意力網絡 (GAT) 和動態多因子模型 (DMFM)，利用產業圖和全市場圖的結構特性進行個股收益率預測，並通過動態投資組合回測評估模型的實際投資績效。

**關鍵字：**圖注意力網絡、股票收益率預測、量化投資策略

# **Application of Graph Neural Networks in Stock Portfolio Optimization: Incorporating Industry Relations and Market Interactions**

Student : Yi Lo

Advisor: Dr. Alex YiHou Huang

Graduate Program of Finance, Department of Information Management and  
Finance  
National Yang Ming Chiao Tung University

## **Abstract**

Write your English abstract here. This research employs Graph Attention Networks (GAT) and Dynamic Multi-Factor Models (DMFM) to predict individual stock returns using structural characteristics of industry graphs and market-wide graphs, and evaluates the practical investment performance through dynamic portfolio backtesting.

**Keywords:** Graph Attention Network, Stock Return Prediction, Quantitative Investment Strategy.

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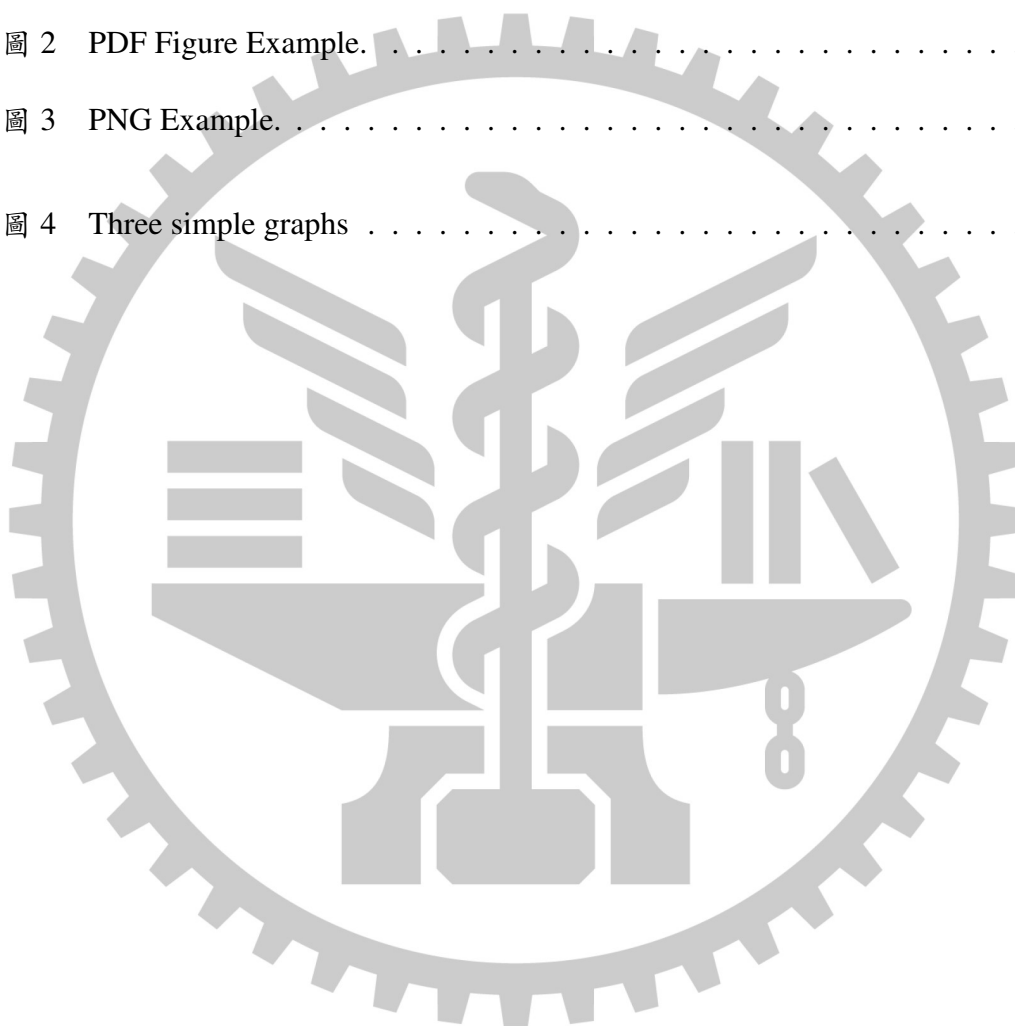
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# 表目錄

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# 第一章、Introduction

語法大幅度修改(!?), 改成 xelatex 去編譯. 現在中文內容可以直接使用**粗體**跟斜體了.

## 1.1 測試 0

### 1.1.1 測試 1

還有研究一下 overleaf 支援的字體清單: <https://bit.ly/3MocQG3>

目前選擇 TW-Kai, 這個字體同時支援繁體與簡體中文, 有一些特殊字可以直接顯示, 像是之前有人問過的核苷酸.

#### 1.1.1.1 測試 2

Video-based surveillance systems have been widely used in places such as plaza, office, factory, hotel, and conference hall for security purposes[1],[2].

The rest of this paper is organized as follows. Chapter 2 reviews some related work. Chapter 3 introduces our system architecture. Chapter 4 explains the details of our pairing algorithm. Performance evaluation results are in Chapter 5. Conclusions are in Chapter 6.

## 第二章、Related Work

通常第二段就是寫相關的參考文獻，只有 cite 到的文章才會出現編號並且出現在最後面。舉例來說，如果在 ref.bib 裡放了 10 篇論文，可是內文只有 cite 其中五篇，編譯出來的結果就只會顯示這五篇。Ref 有很多種風格寫法，本篇論文是採用 `bibliographystyle{IEEEtran}`，overleaf 上有其他 style 語法，可以參考：

[https://www.overleaf.com/learn/latex/Bibtex\\_bibliography\\_styles](https://www.overleaf.com/learn/latex/Bibtex_bibliography_styles)

This is related work. The PID issue has been widely studied in the field of computer vision and IoT by using various devices. In the field of computer vision, camera is the most popular device. Face recognition technologies are surveyed in [3]. Reference [4] focuses on how to collect a very large training dataset and build a very deep CNN model for face recognition, but training process is extremely computationally expensive. A hybrid RFID and computer vision system for localization and tracking of RFID tags is proposed in [5]. Reference [6] presents a solution which combines RFID with object tracking through cameras. Reference [7] presents a fusion system consisting of an RFID reader and a camera crew on a mobile robot platform to track people. These works [5],[6],[7] fuse data from camera and RFID, but their accuracy highly depends on the density of RFID antennas. Thus, they are not suitable for longer range PID. Reference [8] proposes a fast multi-people tracking algorithm for service robots through RGB-D camera. In [9], people detection is realized by dense depth data, called Histogram of Oriented Depths (HOD).

## 第三章、System Model

如果想在 latex 裡面插入表格, 可以搜尋 latex table generator, 有很多線上網站可以參考. 我個人都是使用線上網站去產生大致的語法, 然後再根據個人喜好去做微調, wiki-book 有很多資料可以參考, 網址在這邊: <https://en.wikibooks.org/wiki/LaTeX/Tables>

如果要引用表格, 記得在 table 裡加上 label 的語法, 然後就可以呼叫 Tab 1, 寫中文的就是表 1. 通常 Table 的 caption 是寫在表格的上面, 圖片則是放在下面.

表 1: This is a table.

A	1	4	7
B	2	5	8
C	3	6	9

後來在圖書館的“2022 研究攻略營論文寫作實戰技巧(顏安孜老師)”看到另一種作法, 網址: <http://bit.ly/3yE06Hx>

裡面的講義有提到 Excel2LaTeX, 細節可以去看圖書館的連結, 裡面有放講義, 下方是顏安孜老師的講義截圖

表 2: Comparison on model efficiency and model size.

Model	Training & Test	Model Size
LTD-GCN	<b>11ms &amp; 4.5ms</b>	2.50M & 2.50M
LTD-GCN-i	<u>13ms</u> & <u>4.6ms</u>	2.75M & 2.76M

## 如何製作表格

### • 建議使用 Excel2LaTeX

```

498 Immediately following this sentence is the
499 point at which Table 1 is included in the
500 input file; compare the
501 placement of the table here with the table
502 in the printed output of this document.
503
504 % t: top, b: bottom, h: here
505 \begin{table}[t]
506 \caption{Frequency of Special Characters}
507 \label{tab:freq}
508 \begin{tabular}{ccl}
509 \toprule
510 Non-English or Math&Frequency&Comments\\
511 \midrule
512 \O & 1 in 1,000 & For Swedish names\\
513 \pi & 1 in 5 & Common in math\\
514 \$ & 4 in 5 & Used in business\\
515 \Psi^2_1 & 1 in 40,000 & Unexplained usage\\
516 \bottomrule
517 \end{tabular}
518 \end{table}

```

Conference acronym 'XX, June 03–05, 2018, Woodstock, NY

Table 1: Frequency of Special Characters

Non-English or Math	Frequency	Comments
Ø	1 in 1,000	For Swedish names
π	1 in 5	Common in math
\$	4 in 5	Used in business
Ψ <sup>2</sup> <sub>1</sub>	1 in 40,000	Unexplained usage

to complete a  
the rights man-  
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the author will  
it has been sub-  
must be copied  
source is compiled,  
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est page.  
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e correct set of

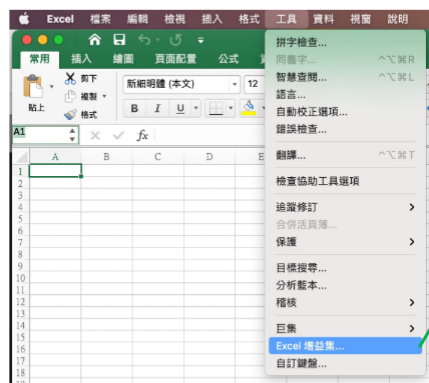
to be aligned properly in rows and columns, with the desired horizontal and vertical rules. Again, detailed instructions on **tabular** material are found in the *LaTeX User's Guide*.

Immediately following this sentence is the point at which Table 1 is included in the input file; compare the placement of the table here with the table in the printed output of this document.

To set a wider table, which takes up the whole width of the page's

48

## Excel2LaTeX



下載連結: <https://www.ctan.org/tex-archive/support/excel2latex/>

49



50

圖 1: Excel2LaTeX.

## 第四章、Data Fusion Algorithm

這個是插入圖片的範例，圖片都放在 img 資料夾裡面。檔案格式有支援：JPG, PNG, PDF, EPS. 就使用自己習慣的繪圖工具，比較常見的應該就是 power point!? power point 可以把繪圖區另存成 JPG, PNG, 還有 SVG (新版才有，我用的 office 2016 沒有這選項 QQ). SVG 可以再轉成 PDF, 這樣圖片縮放還是會很清楚，可以把範例的兩張圖片都放大來看，應該可以看出差別。我個人都是用 visio 來畫圖，可是都找不到替代工具，如果有好用的繪圖工具麻煩分享交流一下 QQ 也看過蠻多人用 draw.io, 只是這個用起來不太順手。orz 圖片出現的位置是由 latex 去決定，有時候會出現在奇怪的地方，這時候只能多爬文、嘗試各種參數，或者把整段圖片 code 放在前面試試看。

overleaf 上有插入圖片的介紹：[https://www.overleaf.com/learn/latex/Inserting\\_Images](https://www.overleaf.com/learn/latex/Inserting_Images)

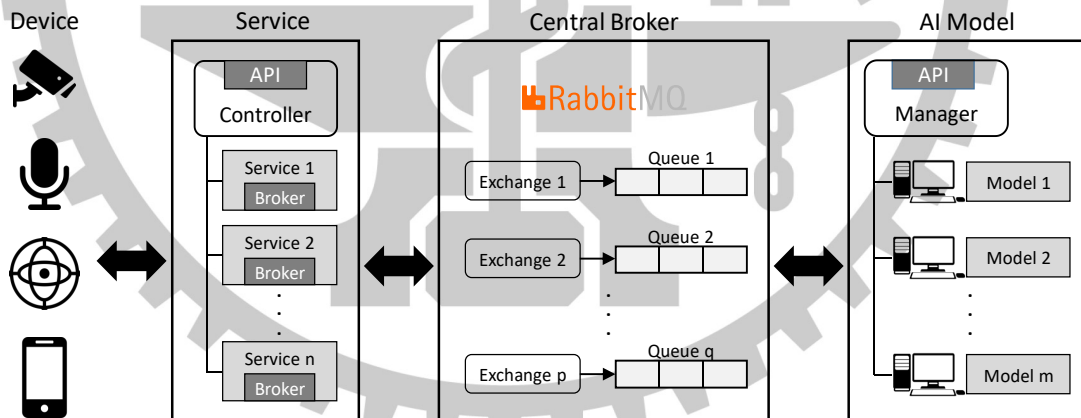


圖 2: PDF Figure Example.

### 4.1 Data Preprocessing

An example for section. Fig 2 is PDF. Fig 3 is PNG.

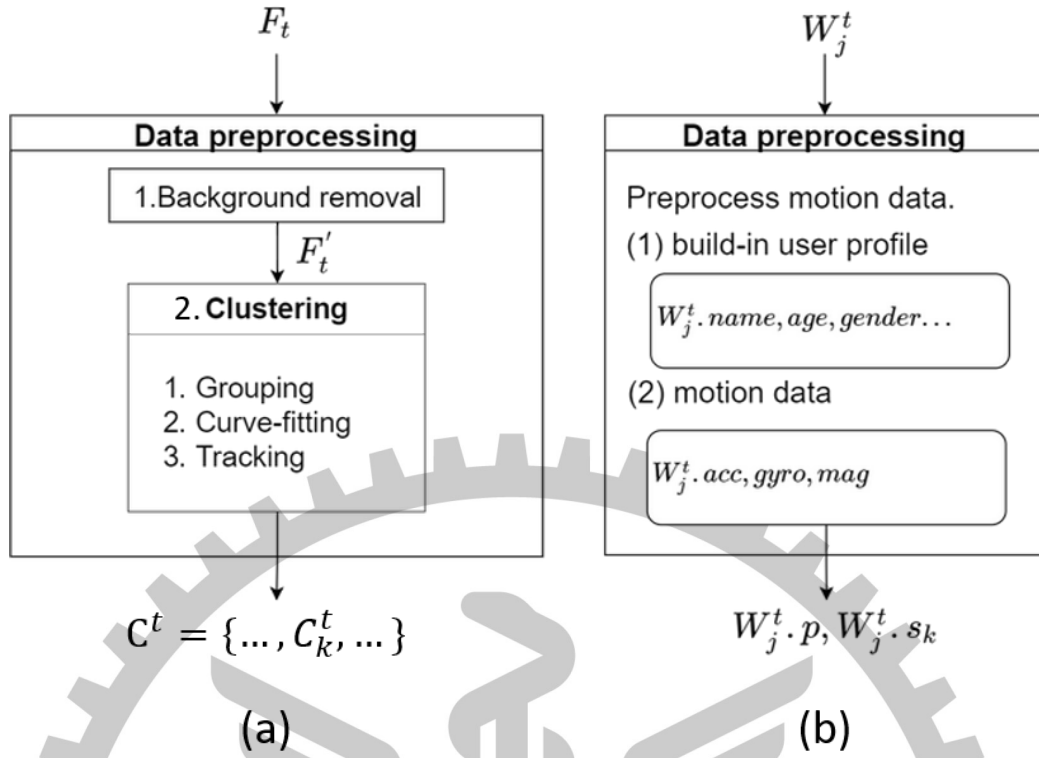


圖 3: PNG Example.

#### 4.1.1 2D LiDAR Data

An example for subsection. 寫中文就是圖 2 跟圖 3.

## 第五章、Performance Evaluation

In this section, 整理效能評估.

下面是 subfigure 的範例 (其實我個人不常用這個語法, 我都直接在繪圖工具上把圖片整合在一起 XD)



圖 4: Three simple graphs



## 第六章、Conclusions

Write your conclusion here.



## 參考文獻

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- [8] M. Munaro and E. Menegatti, “Fast rgb-d people tracking for service robots,” *Autonomous Robots*, vol. 37, no. 3, pp. 227–242, 2014.

- [9] L. Spinello and K. O. Arras, “People detection in rgb-d data,” in *Proc. IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2011, pp. 3838–3843.

