國科會「大專生研究計畫」資工系通過率名列前茅

文稿整理／杜懿洵

資訊工程專題是本校資工系的重要必修課程之一，每年學生的作品都相當精采豐富，今年資工系同學申請國科會「大專生研究計畫」成果傑出，有高達 21 件研究計畫獲得助學金，以下是部份同學們的分享心得：

計劃名稱：Model-Agnostic Meta Action-Constrained RL: From Algorithms to Applications
學生：廖兆琪、孟祥蓉
指導老師：謝秉均 教授

現實生活中，大多數領域都擁有其「限制」的範圍，例如物理上各種機械動作和機器人有移動速度及角度的限制、通訊網路傳輸有頻寬與流量限制。由於這些限制都可以隨時改動，如訓練網路中，switch 根據不同路徑負荷量設計出最有效率的封包傳送路徑；然而，若條件改變，便必須對模型重新進行訓練，相當沒有效率。因此，我們將以 MAML 和 NFWPO 作為解法提出 MetaACRL 此類新穎的研究問題，利用 Meta Learning 的特色，實現於不同限制範圍下訓練出學習力強大之模型的目標。

計劃名稱：運用深度學習於藥物推薦與疾病預測之研究
學生：王健哲
指導教授：彭文志 教授

本計畫旨在應用機器學習演算法於醫療領域，以提升公共利益為目標。計畫的內容包括修改「用藥推薦」模型和設計「疾病預測」模型。透過比較不同用藥推薦模型的架構，我們希望能夠提供醫生更準確的藥物建議，以改善病患的治療效果。同時，我們將利用病患的檢測資料，預測罹病風險，旨在早期發現病患的潛在健康風險。

計劃名稱：AlphaZero 和 MuZero 應用於點格棋遊戲之比較
學生：張可晴、李旻融、紀竺均
指導教授：吳毅成 教授

點格棋 (Dots and Boxes) 因獨特的遊戲規則，導致其遊戲複雜度較高，這引起許多研究採取不同方式以設計出強勁的電腦對局程式。近年來，AlphaZero 以及 MuZero 相繼興起，除了將電腦棋力帶至了另一個新的高度外，也替設計電腦對局程式帶來了新的思考方向。在本研究中，我們以 AlphaZero 和 MuZero 演算法去實作出可用於點格棋遊戲的電腦對局程式；同時，也將比較二者在點格棋遊戲上的應用，是否與其他遊戲應用一樣，展現相當的表現實力。

計劃名稱：探索與使用元宇宙相關技術改善現今人力派遣流程
學生：麥文傑
指導教授：袁賢銘 教授

在元宇宙這一先進概念的誕生之際，隨著其潛在的龐大商業前景不僅引發了全球的關注，更激起了對其底層技術的熱切研究與開發，進程如火如荼。其中，分散式數位身份被視為在元宇宙內具有極大應用潛力的技術之一，因為它可以精準解決數據安全性、個人數位身份的隱私保護以及控制權的關鍵問題。在這一背景下，我們將先行投入精力，對這些先進技術進行深入研究與分析，並計劃將其應用至勞力派遣領域的特定問題中。這一選擇的背後，是基於勞力派遣所需解決的核心問題與元宇宙技術底層需求的相同性。值得一提的是，勞力派遣領域目前正面臨一系列迫切需解決的問題，如個人資料保護的不當處理或濫用、以及勞工身份的偽造等，這些問題的解決恰恰需要我們所研究的分散式數位身份。

計劃名稱：非監督式異常檢測之流模型在機器異音監控之應用
學生：陳建嘉、楊竣喆、邵筱庭
指導教授：黃敬群 教授

本研究以智能工廠為願景，期待以機器學習的方式，訓練出一款能夠以工廠機器發出的聲響作為輸入，來判斷該機器是否有運作異常之情形的模型。現實生活中的異常音訊資料相當少且難以收集，在異常音訊的訓練資料量極小或甚至沒有的狀態下，很難用二元分類器這類以監督式學習為基礎的訓練方式去訓練模型。因此，本研究採用以非監督式學習去訓練模型，使其更符合現實中的條件。流模型在某些異常檢測的研究中，展現出不錯的表現，本研究以流模型為主要架構，使模型能夠學習正常資料之特徵向量分布，藉以判斷測試資料之特徵向量是否有偏離正常資料的特徵向量分布，進而達到檢測異常之目的。

計劃名稱：速適應未曾見過的行動限制：Meta-ACRL 演算法框架
學生：吳文心
指導教授：謝秉均 教授

本計畫首創提出 Action-constrained 問題的 general solution，運用 probabilistic embeddings 學習不同任務之間的異同，最終使得於模型面對與訓練不同的測試任務時，能夠快速適應並決策出符合 action constraints 的行動且取得優異的 reward。第一次做創新演算法的專案，遇到瓶頸時有些慌亂和手足無措，感謝有指導教授和實驗室學長的幫助，才有如今的成果，一路以來困難重重，但也因此收穫許多寶貴經驗。

NSTC Undergraduate Research Fellowship
Department of Computer Science Ranked Among the Best in the Nation

The Computer Science and Engineering Project is one of the important required courses for students in the Department of Computer Science at NYCU. Each year, the students' work displays remarkable brilliance. This year, students applied for the NSTC undergraduate research project, yielding fruitful results, with as many as 21 works receiving grants. Here are some students' sharing below.

Research project: Model-Agnostic Meta Action-Constrained RL: From Algorithms to Applications

Student: Chao-Chi Liao, Hsiang-Jung Meng

Advisor: Professor Ping-Chun Hsieh

Student's sharing: In real life, most fields have their own limitations. For example, various physically mechanical actions and robots have restrictions on movement speed and angle, and communication network transmission has bandwidth and traffic limitations. Since these restrictions can be changed at any time, for example, in the training network, switch designs the most efficient packet transmission path according to different path loads; however, if the conditions change, the model must be retrained, which is quite inefficient. Therefore, we will use MAML and NFWPO as solutions to propose novel research questions such as MetaACRL, and apply the characteristics of Meta Learning to achieve the goal of training models with strong learning power under different constraints.

Research project: Research on the implementation of deep learning in drug recommendation and disease prediction.

Student: Jian-Zhe Wang

Advisor: Professor Wen-Chih Peng

Student's sharing: This project employs machine learning algorithms within the healthcare sector to enhance public interest. The research involves two main components: the revision of the 'medication recommendation' model and the design of a 'disease prediction' model. We aim to improve patient treatment outcomes by comparing various medication recommendation models and providing physicians with more accurate drug recommendations. Simultaneously, we will utilize patient health data to predict disease risk, with the goal of identifying potential health risks in patients at an early stage.

Research project: Comparison of AlphaZero and MuZero applied to the Dots and Boxes Student: Ke-Ching Chang, Ming-Rung Li, Chu-Chun Chi

Advisor: Professor I-Chen Wu

Student's sharing: Due to its unique rules, Dots and Boxes exhibits a higher level of game complexity, leading researchers to explore various approaches in developing powerful computer gaming programs. Recently, AlphaZero and MuZero have emerged as notable examples. These two algorithms, originally designed for computer chess, have also opened up new avenues of thought for computer gaming program design. In this study, we implement a computer gaming program for Dots and Boxes using AlphaZero and MuZero algorithms. Simultaneously, we compare their performance in Dots and Boxes to determine if their performance aligns with that of other gaming applications.

Research project: Exploring and Implementing Metaverse-related Technologies to Enhance the Current Human Resource Dispatching Process

Student: Wen-Chieh Mai

Advisor: Professor Shyan-Ming Yuan

Student's sharing: With the emergence of the Metaverse, a cutting-edge concept with vast commercial potential, it has not only garnered global attention but has also ignited a fervent pursuit of research and development in its fundamental technologies, progressing with great vigor. Among these, decentralized digital identity stands out as a significant potential technology within the Metaverse. It can effectively address critical issues, including data security, the privacy of individual digital identities, and control rights. In this context, we are actively engaging in an in-depth study and analysis of these advanced technologies and applying them to specific problems in the field of labor dispatch. We've chosen this direction because of the similarity between the core problems that labor dispatch needs to solve and the underlying requirements of Metaverse technologies. It's worth noting that the labor dispatch sector is currently grappling with a series of urgent issues that require resolution, such as inadequate protection of personal data and its unauthorized utilization, as well as identity forgery in the labor market. Our research on decentralized digital identity aligns perfectly with the solution to these issues.

Research project: Unsupervised Detection of Anomalous Sounds for Machine Condition Monitoring

Student: Jian-Jia Chen, Chun-Che Yang, Hsiao-Ting Shao

Advisor: Professor Ching-Chun Huang

Student's sharing: This study envisions a smart factory and aims to employ machine learning to train a model capable of detecting machine abnormalities by analyzing the sounds emitted by factory machines. In practical situations, collecting abnormal audio data is challenging due to its rarity. Consequently, training a model using supervised learning methods like binary classification becomes difficult. Therefore, this study utilizes unsupervised learning to train the model, making it more consistent with real-life conditions. The flow model has demonstrated strong performance in some anomaly detection studies. In this study, we employ the flow model as the primary structure to enable the model to learn the eigenvector distribution of normal data. This allows it to determine whether the eigenvector of the test data deviates from the norm and achieve the goal of anomaly detection.

Research Project: Fast Adaptation to Unseen Action Constraints: An Algorithmic Framework of Meta Action-Constrained RL

Student: Wen-Hsin Wu

Advisor: Professor Ping-Chun Hsieh

Student's sharing: This project proposes a general solution to action constraints for the first time. We use probabilistic embeddings to learn the similarities and differences among different tasks, with the expectation that the model can quickly adapt and make decisions that conform to the action constraints, ultimately achieving excellent rewards when facing tasks different from the training data. It was my first time working on an innovative algorithm project, and I sometimes felt flustered and lost when encountering bottlenecks. Thanks to the help of my supervisors and laboratory seniors, I have achieved the current results. Throughout the journey, there were many difficulties, but I also gained a lot of valuable experience.