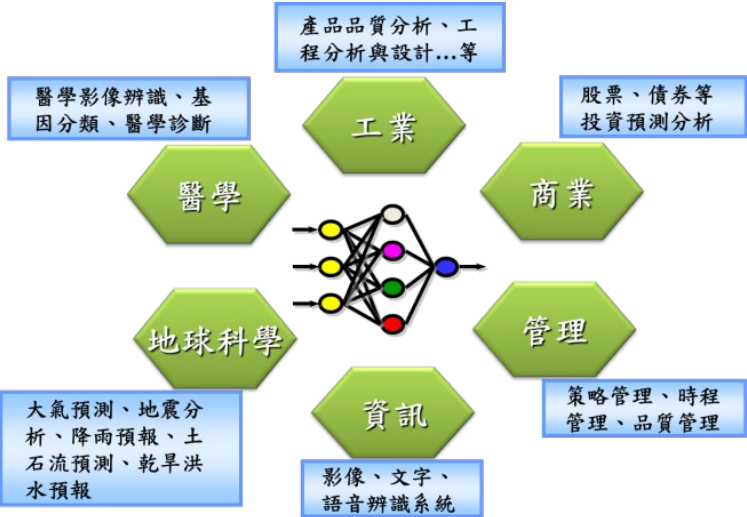


科目名稱	類神經網路：理論與實務 (BSE 5114)	學分	3
上課時間	星期一 14：20~17：20	上課地點	農工九
任課老師	張斐章 教授 E-mail： changfj@ntu.edu.tw 研究室電話：33663452		
課程助教	邱普運 <r07622031@ntu.edu.tw> 研究室電話：33663490		
課程說明	機器學習是近年發展最快速的 AI 議題之一，其中以類神經網路(ANNs)為主的深度學習技術結合巨量資料的處理與應用漸趨熱切，如何快速有效地從資料中篩選、萃取、分類及解析出有用的資訊，創造出高價值的服務，實為一大挑戰。類神經網路具有從環境中擷取資訊，自我學習，從而做出推論之能力，利用電腦的軟體來模擬生物神經系統的資訊處理方式，由人類專家解決問題的實際案例中學習，利用統計、分類、非線性函數的轉換及最佳化原理等，能有效地對大量且複雜之資訊進行統計分析、分類、判識、推估等。類神經網路可解決過去傳統的電腦資訊理論中一些難以突破的瓶頸，例如：生物醫農領域中之判識、分類或推論；工程、科學與資訊管理領域中之模擬與預測、最佳化管理、非線性系統識別、圖形和語音的辨識、自動控制駕駛、電腦遊戲、或者是處理邏輯上的問題等。本課程藉由深入淺出說明 ANN 的相關理論與展示實際研究案例，很適合對 ANN 基本原理具濃厚興趣 及/或 想運用類神經網路科技解決地球科學、生態環境、生物醫學、工程與工商管理領域相關問題之同學共同來研習。 Artificial Neural networks is one of the main constitutional intelligence, the set of biological inspired computing paradigms used to learn and establish baseline behavioral profiles for various entities based on big data. ANNs can play an important role in solving certain problems in science and engineering such as forecasting, pattern recognition, optimization and identification of nonlinear systems etc. This course will cover the basic components of building and applying prediction functions with an emphasis on practical applications. The course will provide basic grounding in concepts such as training and tests sets, overfitting, and error rates. The course will also introduce a range of machine learning algorithms including BPNN, RBFNN, SOM, RNN, CFNN, ANFIS as well as deep learning algorithms such as LSTM and CNN. The course is primarily intended for those individuals, who want to understand the underlying principles of artificial neural networks and want to be able to apply various neurocomputing techniques to solve problems in earth sciences, business administration, ecological environment, biomedical, and engineering. 		

教科書與 主要參考書籍	Textbook: 張斐章、張麗秋，「類神經網路導論：原理與應用(第二版)(CD Inside)」，滄海書局，2015年。 References: 1. Simon Haykin; Neural Networks – A comprehensive foundation, 3 nd Edition, 2009. 2. 類神經網路相關期刊論文導讀 (https://www.researchgate.net/profile/Fi-John_Chang/stats)		
軟體工具	MATLAB、Neural Tool		
課程網址	https://ceiba.ntu.edu.tw/		
教學進度	主題	上課日期	備註
	課程內容簡介、類神經網路簡述	9/9	
	生物神經網路與類神經網路、學習演算法、Neural Tool 簡介	9/16	
	倒傳遞類神經網路(BPNN)	9/23	作業一
	倒傳遞類神經網路(BPNN)	9/30	作業實習
教學進度	相關應用軟體的介紹(M atlab & P ython)	10/7	作業繳交
	輻狀基底函數類神經網路(RBFNN)	10/14	作業二
	聚類演算法(Clustering)	10/21	作業實習
	自組性類神經網路(SOMNN)	10/28	
	回饋式類神經網路(RNN)、長短期記憶體(LSTM)	11/4	作業繳交
	含外變數非線性自回歸模型(NARX)	11/11	作業三
	模糊集合與模糊邏輯系統	11/18	作業實習
	反傳遞模糊類神經網路(CFNN)	11/25	作業繳交
	調適性網路模糊推論系統(ANFIS)	12/02	
	期中考	12/09	
	深度學習(Deep learning)	12/16	
	卷積類神經網路(CNN)	12/23	
	專題演講-Big-data Mining & Applications	12/30	
	期末考周	01/06	期末報告
成績計算方法	1.作業(35%) 2.期中考(35%) 3.期末報告(30%)		

Dr. Fi-John Chang

④ Positions:

- + Distinguished Professor of National Taiwan University
- + Founding President of Taiwan Hydro-Informatics Society
- + Associate Editor of *Journal of Hydrology*
- + Associate Editor of *Hydrological Science Journal*
- + Editorial board : Water
- + Editorial Advisor: Paddy and Water Environment

④ Research of Interest:

- + Hydro-informatics, Water Resources management
- + Artificial Intelligence (AI), Optimization, Machine learning
- + Eco-hydrology, Statistics, System Analysis
- + Water-Food-Energy Nexus



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EDUCATION:

Ph.D. (1988) Civil Engineering, Purdue University, USA
B.S.&M.S. Agriculture Engineering, National Taiwan University, Taiwan

PROFESSIONAL EXPERIENCES:

1992~present	Professor	Dept. of Bioenvironmental Systems Engineering
2009~present	Funder	Taiwan Hydro-Informatics Society, Taiwan
2009~present	Associate Editor	Journal of Hydrology
2016~present	Associate Editor	Hydrological Sciences Journal
2018~Present	Editor Board	Water
2003~2010.7	Director	Agriculture Engineering Research Center (AERC)
1997~2000	Chairman	Dept. of Agriculture Engineering, National Taiwan University,
1994~1997	Director	Hydrotech Research Institute, National Taiwan University, Taiwan

RESEARCH INTERESTS:

Hydrology, Water Resources Management, Artificial Neural Networks, Artificial Intelligence, Ecohydrology, Flood Forecasting, Reservoir Operation, Big-data, Data-mining, Water-Food-Energy Nexus

HONORS AND AWARDS:

Three times	Outstanding Teaching Awards	National Taiwan University
2005; 2009	Outstanding Researcher	National Science Council

PUBLICATIONS: Over 190 articles have been published in peer reviewed journals

- 1.Chang, L.C., Chang, F.J.*, 2001, "Intelligent control for modeling of real time reservoir operation", Hydrological Processes, 15(9): 1621-1634. (Highly Sited Paper)
- 2.Chang, F.J.*, Chen, Y.C., 2001, "A counterpropagation fuzzy-neural network modeling approach to real-time streamflow prediction", Journal of Hydrology, 245: 153-164. (Highly Sited Paper)
- 3.Chang, F. J.*, Chang, Y.T., 2006, "Adaptive neuro-fuzzy inference system for prediction of water level in reservoir", Advanced in Water Resources, Vol. 29 pp.1-10, SCI. (Highly Sited Paper)
- 4.Yanlai Zhou, Fi-John Chang*, Li-Chiu Chang, I-Feng Kao, Yi-Shin Wang, 2018, "Explore a deep learning multi-output neural network for regional multi-step-ahead air quality forecasts", Science of the Total Environment (in press)
- 5.Zhou, Y., Guo, S., Chang, F.J.*, & Xu, C. Y. (2018). Boosting hydropower output of mega cascade reservoirs using an evolutionary algorithm with successive approximation. Applied Energy, 228,
- 6.Uen, T. S., Chang, F. J.*, Zhou, Y., & Tsai, W. P., 2018, "Exploring synergistic benefits of Water-Food-Energy Nexus through multi-objective reservoir optimization schemes", Science of the Total Environment, 633, 341-351.
- 7.Zhou, Y., Guo, S., Chang, F. J.*, Liu, P., & Chen, A. B., 2018, "Methodology that improves water utilization and hydropower generation without increasing flood risk in mega cascade reservoirs", Energy, 143, 785-796.

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14. Cheng, S.T., Herricks, E., Tsai, W.P., Chang, F.J.*, 2016, "Assessing the natural and anthropogenic influences on basin-wide fish species richness", *Science of the Total Environment*, DOI: 10.1016/j.scitotenv.2016.07.120.
15. Tsai, W.P., Chiang, Y.M., Huang, J.L., Chang, F.J.*, 2016, "Exploring the Mechanism of Surface and Ground Water through **Data-Driven Techniques** with Sensitivity Analysis for Water Resources Management", *Water Resources Management*, 1-18.
16. Chang, F.J.*, Chen, P.A., Chang, L.C., Tsai, Y.H., 2016, "Estimating spatio-temporal dynamics of stream total phosphate concentration by **soft computing techniques**", *Science of the Total Environment*, 562, 228-236.
17. Chang, F.J.*, Tsai, M.J., 2016, "A nonlinear spatio-temporal lumping of radar rainfall for modelling multi-step-ahead inflow forecasts by **data-driven techniques**", *Journal of Hydrology*, 30: 1395-1413.
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