

Deep Learning: A Case Study of Research-Led Teaching

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Deep Learning: A Case Study of Research-Led Teaching

- Deep Learning Research
- Deep Learning Teaching
- Deep Learning Research-Led Teaching

Deep Learning: A Case Study of Research-Led Teaching

- The Content of Deep Learning
- CNN, Fast R-CNN, Faster R-CNN, YOLOv3, and SSD
- RNN (LSTM, GRU, etc.)
- Reinforcement Learning
- Manifold Learning
- Autoencoder and Generative Adversarial Networks (GAN)
- Capsule Networks
- Deep Random Forest
- Deep MRF, SqueezeNet and Compressing Networks (ResNets)
- Transfer Learning
- Ensemble Learning

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Deep Learning: A Case Study of Research-Led Teaching

- The background of Deep Learning
- Information Theory (Entropy, Conditional Entropy, Relative Entropy, etc.)
- Graphical Theory (Dynamic Bayesian Networks, Markov Random Fields)
- Calculus and Mathematical Analysis
- Linear Algebra, Tensor Algebra, Parallel Algebra, etc.
- Numerical Analysis (Fitting/Approximation, Matrix Theory, Numerical Solution of Partial Differential Equations, etc.)
- Functional Analysis (Normed Space, Banach Space, Hilbert Spaces, etc.)
- Basic Algebra (Group, Rings, Fields, etc.)

Deep Learning Research

• Publications

- X. Wang, W. Yan. (2019) Multi-perspective gait recognition based on ensemble learning. Springer Neural Computing and Applications (IF: 4.21)
- M. Al-Sarayreh, M. Reis, W. Yan, and R. Klette. (2019) A sequential CNN approach for foreign object detection in hyperspectral images. CAIP'19, pp. 271-283 (Akira Nakamura Award).
- X. Wang, W. Yan. (2019) Gait recognition using multichannel convolution neural networks. Springer Neural Computing and Applications (IF: 4.21).
- X. Wang, W. Yan. (2019) Human Gait Recognition Based on SAHMM, IEEE/ACM Transactions on Biology and Bioinformatics (IF: 2.89).
- X. Wang, W. Yan. (2019) Human gait recognition based on frame-by-frame gait energy images and convolutional long short term memory. International Journal of Neural Systems (IF: 6.507).
- Others: <u>Google Scholar</u>; <u>DBLP</u>

Deep Learning Research



	Wei Qi Yan Director of CeRV, <u>a</u> Verified email at a	Follow	/ING (
ta	Security Surveillance Foren Image Video Vision & Multi Computational Intellig					jence	
TITLE 📴	0 0 0			CITED	BY YE	AR	
Human Gait Recognition Based on SAHMM 2019 X Wang, W Yan IEEE/ACM Transactions on Biology and Bioinformatics 16							
Gait Recognit X Wang, W Yan Neural Computir	ion Using Multichan	nel Convolu	ution Neural Networks		20	019	

An Improved Selective Facial Extraction Model for Age Estimation C Song, L He, W Yan IVCNZ'19 1 (1), 1-7



2019

Graduated PG Students

- M. Al-Sarayreh. Advanced Spectral-spatial Image Analysis for Food Safety and Materials Discrimination (2019)
- X. Liu, Vehicle-related scene understanding using deep learning (2019)
- H. Ji, Early diagnosis of Alzheimer's disease using deep learning (2019)
- A. Iqbal, Image captioning using GRU (2019)
- B. Xiao, Apple ripeness recognition using deep learning (2019)
- C. Liu, Gait recognition using deep learning (2019)
- H. Wang, Real-time face detection and recognition based on deep learning (2018)
- Q. Zhang, Currency recognition using deep learning (2018)
- C. Xin, Multiple flames recognition using Deep Learning (2018)
- Y. Ren, Banknote Recognition in real Time using ANN (2017)
- Y. Shen, Blindspot monitoring using deep learning (2017)
- D. Shen, Flame detection using deep learning (2017)
- K. Zheng, Video dynamics detection using deep neural networks (2017)

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Academic Seminars

Recent Talks:

- > The State-of-the-art Technologies in Deep Learning
- > PG Mathematics for Deep Learning
- > Advanced Deep Learning
- > Deeply Learn Deep Learning
- > Ten Talks on Deep Learning

MATLAB for Deep Learning

- Build advanced network architectures like GANs, Siamese networks, attention networks, and variational autoencoders
- Train a YOLO v2 deep learning object detector
- Deep Network Designer: Graphically design and analyze deep networks
- Define new layers with multiple inputs and outputs, and specify loss functions for classification and regression
- Combine LSTM and convolutional layers for video classification and gesture recognition
- Work with MobileNet-v2, ResNet-101, Inception-v3, SqueezeNet, NASNet-Large, and Xception

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Courses Offered

- Deep Learning Special Topic (COMP825), S1, 2020
- Shandong Academy of Sciences (SDAS) China, 2019
- China Jiliang University (CJLU) China, 2018

Deep Learning – Special Topic (COMP825), S1, 2020

PRESCRIPTOR:

This paper emphasizes on fundamental skills and conceptual understandings in problem solving for deep learning. Examples of successful deep learning, relevant algorithms and tools will be also introduced. In this paper, students' research expertise will be trained so as to consider conducting a thesis project in future.

LEARNING OUTCOMES:

On successful completion of this paper students will be able to:

- 1. Demonstrate advanced understanding of the state-of-the-art in the theory and practice of deep learning.
- 2. Undertake rigorous analysis of how to solve problems in deep learning.
- 3. Understand how to conduct data collection, data augmentation, data labelling, data visualization.
- 4. Design and analyse algorithms of deep learning.
- 5. Conduct evaluations for deep learning algorithms.

Deep Learning – Special Topic (COMP825), S1, 2020

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CONTENT:

- Introduction to deep learning
- Knowledge of data collection for deep learning
- Theory, algorithms and computational aspects of deep learning
- Fundamental deep neural networks (CNNs, RNNs, R-CNN, YOLO, ResNet, etc.)
- Machine learning algorithms (transfer learning, reinforcement learning, ensemble learning, etc).
- Deep learning tools and applications

Deep Learning – Special Topic (COMP825), S1, 2020

ASSESSMENT PLAN:

Assessment Event		E-submission ⁱ		Weighting %	Learning Outcomes						
Research Project Presentation (Ora presentations with Slides or Poster	100		40%	1,2,3,4,5							
Research Project Report (Proposals or Reports, etc.			100		60%	1,2,3,4,5					
Grade Map	Grade	e Ma	p 1:								
R.D.E.S.CRIPTOR	A+ B+	A B	A- <u>B</u> -	P P	ass with Distinct ass with Merit	ion					
		C	<u>C</u> -	P Fa	ass ail						
Overall requirement/s to pass the paper:											
To pass the paper, the student needs at least a C-											

Deep Learning – Special Topic (COMP825), S1, 2020

COMP825 – Deep Learning - Semester 1, 2020

RESEARCH PROJECT PROPOSAL

The aim of this project proposal is to identify what the relevant research work in following one or two semesters through literature review and experiential learning from this course: deep learning (COM825). The expansive and extensive knowledge obtained from this proposal design and writing will be applied to future study and other research projects, which will build the confidence and competence in conducting relevant research. It is highly recommended to start from a survey of a series of relevant research articles and complete this proposal based on the related work.

• How could research lead teaching?

- to inject (update) latest research into the teaching
- to ensure that the curriculum delivers the skills needed for students to engage in research
- to require students to engage in research projects or dissertations
- to enable students to be creative and critical thinkers
- to engender a life-long interest in learning

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• How could research lead teaching?

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- Research-informed where curriculum reflects latest thinking and knowledge in the field of study
- Research-driven where students are taught research findings in their field of study
- Research-oriented where students learn research processes and methodologies
- Research-tutored where students learn through critique and wide-ranging discussion between themselves and staff who can draw upon a deep understanding of thinking and knowledge in their field
- Research-based learning where students learn as researchers and develop research skills on actual projects led by academic staff





- How could teaching return research?
- Research-led teaching has transformation and extension of knowledge
- Teaching should be informed by pedagogic research
- A mastery of the field of inquiry and its particular concerns
- Bring classroom to understanding of the search for knowledge and the excitement of discovery
- Integration of research into the curriculum
- High-quality teaching sits alongside high-quality research, let them meet
- Strengthen the links between discovery, learning, and engagement
- Enhance the nexus in practice: implementations, experimentations, demonstrations, simulations, evaluations, etc.

References

- M. Malcolm (2014) A critical evaluation of recent progress in understanding the role of the research-teaching link in higher education, High Education, 67:289–301
- G. Visser-Wijnveen (2015) A knowledge model of the researchteaching nexus, Research into Higher Education, Newport, UK
- Commentary on Issues of Higher Education and Research, Office of the Vice-Chancellor, UOA, 2010.

Questions?