

# Caiwen Xu

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**Objectives:** To obtain an offer of acceptance into the MRes/PhD BME program



## Educational Background

**Northeastern University, Shenyang, China**

Sept.2016-Jun.2019

B.E. in Biomedical Engineering

GPA: 88.1/100 (3.81/5.0)

Related coursework: *Advanced Mathematics, Introduction to Computer and C Programming Language, C++ Programming Design, Computer Graphics and Visualization, Database Principal, Data Structure, Signal and System, Technology of Analog Electronics, etc.*

## Research Experiences

**Project: COVID-19 Identification using CT images and deep learning**

Apr.2020-Present

*Key Laboratory of Intelligent Computing in Medical Image, Ministry of Education, Northeastern University, Shenyang, China*

- ◆Used multiple instance learning to distinguish COVID-19 from community-acquired pneumonia (CAP). The training and test sets were separated by patients in every fold in 10-fold cross-validation and the performance of the model was evaluated in a cohort of 241 patients; The proposed method achieved an accuracy of 95%. The paper is being written.
- ◆Further trained ResNet-50 on our dataset and took the network as a feature generator;
- ◆Utilized a combination of PCA and LDA to project high-dimension features into a low-dimension space and took Citation KNN as a classifier;
- ◆Performed Grad-CAM algorithm to visualize the reasons for deep CNN decision-making and the reason for Citation-KNN' decision was also explained by finding representative instances.
- ◆Compared several CNN models (MedicalNet (3D-ResNet-50), ResNet-50 and Xception), feature selection methods(Lasso and reliefF) and feature dimension reduction methods (PCA, LDA, PLS);
- ◆The future work in the current program will include automatic detection of lesion, integration of deep-learning and multiple-instance learning and studying the vascular changes of COVID-19 patients in different datasets.

**Project: Deep CNN transferred multiple instance learning for COPD identification using CT images**

Apr.2019-Dec.2019

*Key Laboratory of Intelligent Computing in Medical Image, Ministry of Education, Northeastern University, Shenyang, China*

- ◆Proposed a hybrid method called Deep CNN transferred multiple instance learning (DCT-MIL) to study the classification of COPD and healthy controls via CT images;
- ◆Used a data reduction strategy;
- ◆Extracted the outputs (features) of a certain layer from CNN;
- ◆Compared three MIL models: Citation k-Nearest-Neighbor (Citation-KNN), multiple instance support vector machine (MI-SVM), and expectation-maximization diverse density (EM-DD), and the experiment showed Citation-KNN performed best;
- ◆A patent has been accepted and is being reviewed (Application No.: 202010189494.8; file No.: 2020031800945740);

◆ As the first author, one paper has been published in the international journal of Physics in Medicine and Biology (Impact factor, 2.883).

**Group project, Expressway Intelligence Toll System**

Jul.2018-Aug.2018

Neusoft Talent Training Center

- ◆ Responsible for automatically segmenting character blocks by using SVM to screen license plates and ANN to recognize characters;
- ◆ Mainly used C++ language for programming.

**Extracurricular Activities**

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Debater, Xiamen Summer Vacation Social Practice Group

Jul.2018

- ◆ Got a spot into key teams

Team leader, Admission Presentations Social Practice in Anshan

Jan.2017

- ◆ Participated in debating and got a spot into key teams

**Awards and Honors**

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Team's second and sixth place in school sports meeting swimming contests

2018&2019

The third prize of scholarship of Northeastern University

2017&2018

**Publication**

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Caiwen Xu, Shouliang Qi, Jie Feng, Shuyue Xia, Yan Kang, Yudong Yao, Wei Qian. DCT-MIL: deep CNN transferred multiple instance learning for COPD identification using CT images. [Accepted Manuscript online 1 April 2020]. Physics in Medicine and Biology. DOI: 10.1088/1361-6560/ab857d

**Skills**

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**Language skills:** IELTS 6.5 (Reading: 7.5, Listening: 7, Writing: 5.5, Speaking: 5.5)

**Computer skills:**

Programming Language: Matlab, Python, C++, C

Deep Learning Platform: PyTorch, TensorFlow, Keras