Weijia Li

PostDoc Researcher, Department of Information Engineering, The Chinese University of Hong Kong

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Education

Tsinghua University
Beijing, China

PH.D. IN DEPARTMENT OF EARTH SYSTEM SCIENCE
Sep. 2014 - July 2019

- Supervisor: Prof. Haohuan Fu
- I'm leading the remote sensing image analysis group in our lab. My research focus on deep learning based remote sensing image classification, object detection, and semantic segmentation on high performance platform

Imperial College London
London, UK

JOINT PH.D. IN DEPARTMENT OF COMPUTING
Nov. 2016 - Nov. 2017

- Supervisor: Prof. Wayne Luk (`https://www.doc.ic.ac.uk/~wl/`)
- Topic: FPGA-based real-time remote sensing image processing

Sun Yat-sen University
Guangdong, China

B.S. IN DEPARTMENT OF COMPUTER SCIENCE
Sep. 2010 - Jun. 2014

WORK EXPERIENCE

The Chinese University of Hong Kong
Hong Kong, China

POSTDOC IN DEPARTMENT OF INFORMATION ENGINEERING
Nov. 2019 - Present

- I'm a postdoc researcher of the CUHK-Senstime Joint Lab (MMLab, `http://mmlab.ie.cuhk.edu.hk/`), working with Prof. Dahua Lin
- I'm also a part-time researcher of the Senstime Group Limited, collaborating with the remote sensing business unit
- My research focus on developing novel and practical methods for remote sensing image understanding. I'm currently working on interactive annotation, semantic segmentation, and 3D reconstruction of buildings from large-scale and high-resolution satellite images

Social Experience

Intern
MSRA

RESEARCH CONNECTION GROUP IN MICROSOFT RESEARCH ASIA
Feb. 2013 - Jun. 2013

- In charge of the corporation with researchers and universities

Guest Editor
Remote Sensing

REMOTE SENSING JOURNAL
Jul. 2020 - Present

- Special Issue on Applications of Individual Tree Detection (ITD)

Reviewer

REVIEWER OF THE FOLLOWING SCI JOURNALS:
Jan. 2017 - Present

- Remote Sensing of Environment, IEEE Transactions on Geoscience and Remote Sensing, Remote Sensing, IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, International Journal of Remote Sensing, Computers and Electronics in Agriculture

Session Chair
IEEE

IEEE INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM
Jul. 2017

- In charge of the session of road and traffic detection

Teaching Assistant
Tsinghua

COURSE OF GEOSCIENCE BIG DATA ANALYSIS
Feb. 2018 - Jun. 2018

- In charge of preparing course assignments and participate in preparing course slides

Selected Awards

2017	**Scholarship,** National Scholarship for Graduate Student		*China*
2016	**Scholarship,** Schlumberger Scholarship for Computing Earth Science		*Schlumberger*
2013	**1st place,** IEEE/IBM International Smarter Planet Challenge		*IEEE/IBM*
2011	**3th place,** Microsoft Kinect Pioneer		*Microsoft*

Research Projects

My research interests include deep learning based land cover classification, object detection, and semantic segmentation for remote sensing images. I am also experienced in high performance computing for large-scale remote sensing data processing. Participated projects include:

Integrating Google Earth Images with Landsat Data to Improve 30-m Land Cover Mapping

PROJECT LEADER   *Dec. 2017 - Aug. 2019*

- We integrate free and public Google Earth high-resolution images with Landsat data to improve 30m-resolution land cover mapping in China.
- Considering the characteristics of the Google Earth imagery and the Landsat data, we designed a novel deep convolutional neural network based land cover mapping approach which takes full advantages of different sources of remote sensing data.
- Our proposed method achieves the classification accuracy of 84.4% on the whole validation dataset in China, improving the previous state-of-the-art accuracy by another 4.5%, with much fewer confusions between different vegetation types and the impervious type.
- Related work was published in **Remote Sensing of Environment**.

Deep Learning Based Oil Palm Tree Detection from High-Resolution Satellite Images

PROJECT LEADER   *Jul. 2016 - Jan. 2019*

- Being an important economic crop that contributes 35% of the total consumption of vegetable oil, remote sensing-based quantitative detection of oil palm trees has long been a key research direction for both agriculture and environmental purposes.
- We proposed the first deep learning based framework for large-scale oil palm tree detection using high-resolution satellite images in Malaysia.
- Our proposed approach achieves a much higher average F1-score of 95% in our study area compared with existing oil palm detection methods, and much fewer confusions with other vegetation and buildings in the whole image detection results.
- Related work was published in **Remote Sensing in 2016 and 2019** and **IGARSS 2017**.

Semantic Segmentation based Oil Palm Mapping From High-resolution Satellite Images

PROJECT LEADER   *Aug. 2018 - Feb. 2019*

- We proposed a novel deep learning-based semantic segmentation approach, named RCANet, to obtain finer oil palm plantation maps from high-resolution satellite images. The proposed Residual Channel Attention Unit reuses the low-level features extracted from the encoder part through upsampling, effectively enhancing the discriminative features and suppressing the indiscriminate features.
- Experiment results were evaluated by our proposed Malaysian Oil Palm Plantation Dataset (MOPPD) collected from Google Earth high-resolution images. Our RCANet achieves the OA of 96.88% and the mean IoU of 90.58%, improving the OA by 2.03%-3.96% and the mean IoU by 2.13%-5.44% compared with the other semantic segmentation methods (i.e. FCN, U-Net and FC-DenseNet).
- Related work was published in **International Journal of Remote Sensing**.

Semantic Segmentation based Building Extraction using GIS Data and Satellite Imagery

PROJECT LEADER   *April 2018 - Jan. 2019*

- We proposed a U-Net based method for building footprint extraction from high-resolution satellite images. We explored the potential of integrating public GIS map data with WorldView-3 satellite images for building extraction in four cities.
- Our method won the fifth place in the Building Extraction Track of DeepGlobe - CVPR 2018 Satellite Challenge.
- Related work was published in **CVPR Workshop on DeepGlobe Satellite Challenge 2018 (CVPRW 2018)** and **Remote Sensing**.

Deep Learning based Land Cover Mapping in Africa using Landsat Images

PROJECT LEADER   *Jul. 2015 - Jun. 2016*

- We proposed the first deep learning based framework for large-scale remote sensing data classification and land cover mapping in Africa.
- Our proposed Stacked Auto-encoder based method achieves an overall classification accuracy of 78.99%, which is higher than the accuracy achieved by other three classifiers based on the whole test dataset of Africa.
- Related work was published in **International Journal of Remote Sensing**.

A Multi-class SVM for Multicore and Many-Core Architectures

PROJECT LEADER   *Jan. 2016 - Jan. 2017*

- We designed and implemented a multi-class MIC-SVM (MMSVM), a highly efficient parallel SVM for multi-core and many-core architectures, such as the Intel Ivy Bridge CPUs and Intel Xeon Phi co-processor (MIC).
- Compared with the widely used LIBSVM, our MMSVM achieves 6.3–31.1 and 4.9–32.2 times (training/classification) speedups on MIC, and 6.9–14.9 and 5.5–22.1 times speedups on Ivy Bridge CPUs, for several real-world remote sensing datasets.
- Related work was published in **IEEE journal of selected topics in applied earth observations and remote sensing**.

Cross-regional oil palm tree detection via domain adaptation network

PROJECT LEADER   *Aug. 2019 - Jul. 2020*

- We proposed an adaptive object detector named MADAN for oil palm tree detection across different satellite images, which is the first work for large-scale domain adaptive tree crown detection using multi-source and multi-temporal remote sensing images.
- MADAN improved the detection accuracy by 14.98% compared with the Baseline method (without DA), and 3.55%-14.49% compared with six existing domain adaptation methods.
- Related work was published in **ISPRS Journal of Photogrammetry and Remote Sensing**.

Joint Semantic-Geometric Learning for Polygonal Building Segmentation

PROJECT LEADER *Nov. 2019 - Present*

- We design a multi-task segmentation network for joint semantic and geometric learning via three tasks, i.e., pixel-wise building segmentation, multi-class corner prediction, and edge orientation prediction.
- We propose a simple but effective vertex generation module for transforming the segmentation contour into high-quality polygon vertices. We further propose a polygon refinement network that automatically moves the polygon vertices into more accurate locations.
- Results on two popular building segmentation datasets demonstrate that our approach achieves significant improvements for both building instance segmentation (with 2% F1-score gain) and polygon vertex prediction (with 8% F1-score gain) compared with current state-of-the-art.
- Related work was accepted by **AAAI 2021**.

3D Building model reconstruction from monocular remote sensing images

PROJECT LEADER *April 2020 - Present*

- We design a multi-task deep neural network for effectively learning the geometric property of oblique images, the visible parts of a building and their relations, which significantly improves the segmentation boundaries compared with current methods.
- We propose an objective optimization method that integrates the outputs of the multi-task network for building reconstruction, producing accurate 3D model for buildings with various heights and complex shapes.
- We release a new dataset for monocular 3D building reconstruction, including oblique images of multiple views and over 200,000 annotated buildings of a wide range of heights.
- Related work is under review by **CVPR 2021**.

Publications

[1] **Weijia Li**, Wenqian Zhao, Huaping Zhong, Conghui He, and Dahua Lin. Joint Semantic-Geometric Learning for Polygonal Building Segmentation. AAAI 2021 (Accepted, CCF A conference).

[2] **Weijia Li**, Runmin Dong, Haohuan Fu*, Jie Wang, Le Yu, and Peng Gong. Integrating Google Earth imagery with Landsat data to improve 30-m resolution land cover mapping. Remote Sensing of Environment. 2020 Feb 1;237:111563. (SCI, IF=9.085)

[3] Juepeng Zheng, Haohuan Fu, **Weijia Li***, Wenzhao Wu, Yi Zhao, Runmin Dong, Le Yu. Cross-regional oil palm tree counting and detection via a multi-level attention domain adaptation network. ISPRS Journal of Photogrammetry and Remote Sensing. 2020 Sep 1;167:154-77. (SCI, IF=7.319)

[4] Juepeng Zheng, Haohuan Fu, **Weijia Li***, Wenzhao Wu, Le Yu, Shuai Yuan, Tan K Pang, Kasturi D Kanniah. Growing status observation for oil palm trees using Unmanned Aerial Vehicle (UAV) images. ISPRS Journal of Photogrammetry and Remote Sensing. 2020. (Accepted, SCI, IF=7.319)

[5] Runmin Dong, **Weijia Li***, Haohuan Fu, Lin Gan, Le Yu, Juepeng Zheng, and Maocai Xia. Oil palm plantation mapping from high spatial-resolution remote sensing images using deep learning. International Journal of Remote Sensing. 2020 Mar 3;41(5):2022-46. (SCI, IF=2.976)

[6] **Weijia Li**, Conghui He, Haohuan Fu*, Juepeng Zheng, Runmin Dong, Maocai Xia, Le Yu and Wayne Luk. A Real-Time Tree Crown Detection Approach for Large-Scale Remote Sensing Images on FPGAs. Remote Sensing, 2019, 11(9), p.1025. (SCI, IF=4.509)

[7] **Weijia Li**, Conghui He, Jiarui Fang, Juepeng Zheng, Haohuan Fu* and Le Yu. Semantic Segmentation-Based Building Footprint Extraction Using Very High-Resolution Satellite Images and Multi-Source GIS Data. Remote Sensing, 2019, 11(4), 403. (SCI, IF=4.509)

[8] **Weijia Li**, Runmin Dong, Haohuan Fu*, and Le Yu*. Large-Scale Oil Palm Tree Detection from High-Resolution Satellite Images Using Two-Stage Convolutional Neural Networks. Remote Sensing, 2019, 11(1),11. (SCI, IF=4.509)

[9] **Weijia Li**, Haohuan Fu*, Yang You, Le Yu, and Jiarui Fang. Parallel Multiclass Support Vector Machine for Remote Sensing Data Classification on Multicore and Many-Core Architectures. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 2017, 10(10), pp.4387-4398. (SCI, IF=3.827)

[10] **Weijia Li**, Haohuan Fu*, Le Yu, and Arthur Cracknell. Deep Learning Based Oil Palm Tree Detection and Counting for High-Resolution Remote Sensing Images. Remote Sensing, 2016, 9 (1), 22. (SCI, IF=4.509, Citations=187, **ESI highly cited paper**)

[11] **Weijia Li**, Haohuan Fu*, Le Yu, Peng Gong, Duole Feng, Congcong Li, and Nicholas Clinton. Stacked Autoencoder-based deep learning for remote-sensing image classification: a case study of African land-cover mapping. International Journal of Remote Sensing, 2016, 37 (23), pp.5632-5646. (SCI, IF=2.976, Citations=92)

[12] **Weijia Li**, Conghui He, Jiarui Fang, and Haohuan Fu. Semantic Segmentation based Building Extraction Method using Multi-source GIS Map Datasets and Satellite Imagery. In IEEE Conference on Computer Vision and Pattern Recognition Workshops, pp. 18-22, 2018. (CVPRW 2018)

[13] **Weijia Li**, Conghui He, Haohuan Fu and Wayne Luk. An FPGA-based tree crown detection approach for remote sensing images. In IEEE International Conference on Field Programmable Technology, pp. 231-234, 2017. (FPT 2017)

[14] **Weijia Li**, Haohuan Fu, and Le Yu. Deep convolutional neural network based large-scale oil palm tree detection for high-resolution remote sensing images. IEEE International Geoscience and Remote Sensing Symposium, pp. 846-849, 2017. (IGARSS 2017)

[15] Runmin Dong, Cong Li, Haohuan Fu, Jie Wang, **Weijia Li**, et al. Improving 3-m Resolution Land Cover Mapping through Efficient Learning from an Imperfect 10-m Resolution Map. Remote Sensing. 2020 Jan;12(9):1418.