# Shengjie (Shawn) Liu

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## EDUCATION

2015 – 2019        **Sun Yat-Sen University**, Guangzhou, China
B.S. in Geographic Information Science (GPA: 3.9/4.0)
Thesis: Deep learning for land use and land cover classification

## WORK EXPERIENCE

Oct 2019 – Present        **The University of Hong Kong**, Pokfulam, Hong Kong
Research Assistant, Department of Physics
- Investigated artificial light at night and light pollution in Hong Kong using satellite and night sky brightness data
- Satellite data including VIIRS Annual/Monthly Composite, Black Marble VNP46A1/A2, Luojia-1, Jilin-1, and ISS

Jul – Aug 2019        **OneSpace Technology Co., Ltd.**, Chongqing, China
Remote Sensing Engineer, Department of Spatial Information
- Applied satellite data for crop mapping, and water and air quality assessment (e.g., chlorophyll a, PM2.5)
- Reduced the need for human annotation and was the key to a three million crop mapping project in Chongqing

Oct 2017 – Apr 2019        **Guangdong Key Lab. of Urbanization and Geo-simulation**, Guangzhou
Undergraduate Research Assistant (Part-time)
- Developed machine learning methods for remote sensing image classification
- Methods: convolutional neural network, multitask learning, active learning, object-based image analysis
- Applications: land use and crop mapping, local climate zone, hyperspectral and PolSAR image classification

Jul 2017 – Dec 2018        **School of Geography and Planning**, Sun Yat-Sen University, Guangzhou
Assistant Lab Manager (Part-time), GIS Lab
- Maintained 82 computers and 2 multimedia systems for classes

Jun – Aug 2016        **Center of Social Survey**, Sun Yat-Sen University, Guangzhou
Interviewer (Internship), China Labor-force Dynamic Survey (Zhuhai Team)
- Conducted face-to-face interviews about job and migration history with 70 families in two communities

## JOURNAL PUBLICATIONS

**Liu, S.**, Shi, Q., and Zhang, L., 2020. Few-shot Hyperspectral Image Classification with Unknown Classes Using Multitask Deep Learning. *IEEE Transactions on Geoscience and Remote Sensing*, Early Access, 2020. doi:10.1109/TGRS.2020.3018879

**Liu, S.**, Luo, H., and Shi, Q., 2020. Active Ensemble Deep Learning for Polarimetric Synthetic Aperture Radar Image Classification. *IEEE Geoscience and Remote Sensing Letters*, Early Access, 2020. doi:10.1109/LGRS.2020.3005076

**Liu, S.**, and Shi, Q., 2020. Local Climate Zone Mapping as Remote Sensing Scene Classification Using Deep Learning: A Case Study of Metropolitan China. *ISPRS Journal of Photogrammetry and Remote Sensing*, 164, 229-242, 2020. doi:10.1016/j.isprsjprs.2020.04.008

**Liu, S.**, and Shi, Q., 2020. Multitask Deep Learning with Spectral Knowledge for Hyperspectral Image Classification. *IEEE Geoscience and Remote Sensing Letters*, Early Access, 2020. doi:10.1109/LGRS.2019.2962768

**Liu, S.**, Qi, Z., Li, X., and Yeh, A.G.O., 2019. Integration of Convolutional Neural Networks and Object-Based Post-Classification Refinement for Land Use and Land Cover Mapping with Optical and SAR Data. *Remote Sensing*, 11(6), p.690. doi:10.3390/rs11060690

## PEER-REVIEWED CONFERENCE PROCEEDINGS

**Liu, S.**, Luo, H., Tu, Y., He, Z., and Li, J., 2018. Wide Contextual Residual Network with Active Learning for Remote Sensing Image Classification. In *IEEE International Geoscience and Remote Sensing Symposium,* July 2018, pp. 7145-7148. doi:10.1109/IGARSS.2018.8517855

## CONFERENCE ABSTRACTS AND PRESENTATIONS

**Shengjie Liu**, 2020. Deep learning for remote sensing image classification: Scene classification of local climate zone and fine-grained classification with unknown classes. In *3rd Urban Remote Sensing Symposium*, November 2020, Shanghai, China.

Chun Shing Jason PUN, Chu Wing SO, Nok Yan Janet CHANG, **Shengjie LIU**, Lina CANAS, Constance E. WALKER, and Sze Leung CHEUNG, 2020. A Multinational Study of Night Sky Brightness patterns: preliminary results from the Globe at Night – Sky Brightness Monitoring Network (GaN-MN). In *6th International Conference on Artificial Light at Night (ALAN)*, June 2020, Lleida, Catalonia, Spain.

## WORKING PAPERS

**Shengjie Liu**, Chu Wing So, Nok Yan Janet Chang, Chun Shing Jason Pun et al. Understanding remotely sensed nighttime lights with field measurements and land use data: A case study of Hong Kong. (manuscript available on request)

**Shengjie Liu**, Qian Shi. Multi-label local climate zone mapping as scene classification using very high resolution imagery: Preliminary result of Hong Kong. Preprint submitted to IGARSS 2021.

**Shengjie Liu**, Chu Wing So, Chun Shing Jason Pun et al. High inequality of artificial light due to commercial and sports lighting in Hong Kong. (manuscript available on request)

## HONORS AND AWARDS

| | |
|---|---|
| 2020 | Arctic Code Vault Contributor, GitHub |
| Nov 2019 | Second Price (5 000 CNY), The 1st Orbita Hyperspectral Satellite Data Processing Paper Contest |
| | - Estimating PM2.5 and PM10 directly from TOA reflectance using hyperspectral data and multitask learning |
| Dec 2018 | Scholarship of the EMBA Alumni Association for Real Estate of Sun Yat-Sen University |
| Dec 2018 | The First Prize of Excellent Undergraduate Scholarship, Sun Yat-Sen University |

## PROFESSIONAL ACTIVITIES AND SERVICES

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|---|---|
| 2020 – | Reviewer for *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing (2), Pattern Recognition Letters, Urban Climate, Remote Sensing Letters.* |
| 2018 – | Member, IEEE Geoscience and Remote Sensing Society |

## SKILLS

Coding languages: Python, C/C++, MATLAB, HTML5, LaTeX
Coding in Python: TensorFlow, Keras, PyTorch, NetworkX, Matplotlib
Academic software: GeoDa, ArcGIS, QGIS, ENVI, eCognition, Gephi, OriginLab
General software: VideoPad Video Editor, Adobe Illustrator

## SELECTED PROJECTS

**I have participated deeply in the following funded projects of my advisors or collaborators**

**Effects of external lighting on the environment**
- Environment and Conservation Fund (Hong Kong) 2018-125, PI: Dr Chun Shing Jason Pun
**Land use classification based on deep fusion of remote sensing imagery and social sensing data**
- NSFC 61976234, PI: Dr Qian Shi
**Scene-target-pixel transfer learning for remote sensing image classification**
- NSFC 61601522, PI: Dr Qian Shi


**Below are projects/subprojects that I was the main investigator (did the research)**

2020       **High inequality of artificial light due to commercial and sports lighting in Hong Kong**
- Commercial and sports lighting contributed 41% and 17% of the total light emission in downtown Hong Kong
- Sports lighting had a Gini coefficient 0.25 higher than that of streetlights, while street lighting was evenly distributed across districts
- Buildings were bluer than streets: Ratios of light emission are 42:41 for blue lights and 37:47 for red lights
- Manuscript entitled *High inequality of artificial light due to commercial and sports lighting in Hong Kong*


2020       **Analyzing the relationship of up-to-down and down-to-up nighttime lights**
- Found a linear relationship between up-to-down night sky brightness and down-to-up nighttime lights
- Correlation varies depending on the spaceborne data: R=0.73 for Luojia-1 nighttime images; R between 0.81 and 0.99 for images captured at the International Space Station (ISS)
- Switching off unnecessary external lights at midnight significantly reduced downtown lights by two orders of magnitude as observed in the ISS images
- Manuscript entitled *Understanding remotely sensed nighttime lights with field measurements and land use data: A case study of Hong Kong*


2020       **U- and inverted U-shaped relationship between Flickr photo density and nightlight**
- Found that People prefer to take photos in bright urban centers and dark green parks
- Found a U- and inverted U-shaped relationship between nightlight (x-axis) and Flickr photo density (y-axis)
- Submitted to the Deep City Symposium Latsis EPFL 2020–21
- Flickr density map (change "Hong-Kong" to "Singapore" or "Toronto"): https://sjliu.me/Flickr/Hong-Kong/


2020       **Hyperspectral crop mapping with unknown classes** (open-set recognition)
- Empowered deep learning models with the ability to say "I don't know"
- Developed a multitask deep learning method (classification and reconstruction) to compare the reconstructed and original spectral profiles and reject the unknown classes
- Published in *IEEE TGRS* entitled *Few-shot Hyperspectral Image Classification with Unknown Classes Using Multitask Deep Learning*


2019       **Local climate zone mapping in metropolitan China**
- Developed an artificial network named LCZNet to classify satellite scene images to local climate zones
- Generated local climate zone maps in fifteen major cities in China
- Published in *ISPRS Journal P&RS* entitled *Local Climate Zone Mapping as Remote Sensing Scene Classification Using Deep Learning: A Case Study of Metropolitan China*
- Project page: https://sjliu.me/lcz

2019 **Estimating PM2.5 and PM10 directly from TOA reflectance using Zhuhai-1 hyperspectral data**
- Developed a Python script to covert raw Zhuhai-1 hyperspectral data to Top-of-Atmosphere reflectance
- Developed a multitask artificial network to simultaneously predict PM2.5 and PM10 concentration
- Won the 2nd Price of the 1st Orbita Hyperspectral Satellite Data Processing Paper Contest
- Project page: https://sjliu.me/Estimation-of-PM2.5-PM10-from-Satellite-Imagery

2019 **Crop mapping in Chongqing, China**
- Developed advanced neural networks for crop mapping using Sentinel-2 and Gaofen satellite imagery
- Key to win a three-year three million project entitled *Digital Map of Agricultural Industry in Yubei District, Chongqing* supported by the Chongqing Agriculture and Rural Committee
- News: https://web.archive.org/web/20200923163536/http://www.onespacechina.com/news20191130/

2018 **Using DMSP/OLS nighttime light data to capture the collapse and rise of post-Soviet states**
- Funded by the National Undergraduate Innovative Project (No. 201810558050, 10 000 CNY)
- Found that most light-decreased areas are related to mining industries based on spatial analysis
- Identified the sources of decreased night lights in fifteen post-Soviet countries by classifying high-resolution Google satellite images and locating their latitude and longitude in DMSP/OLS data

2018 **Active deep learning for remote sensing image classification** (Class: Hyperspectral Analysis)
- Developed a light-weight convolutional network that can run on CPU for image classification
- Integrated the light-weight network with active learning to reduce the need of training samples
- Published in *IGARSS 2018* entitled *Wide Contextual Residual Network with Active Learning for Remote Sensing Image Classification*

2018 **Urban structure discovery in the Pearl River Delta**
- Discovered urban structure in the Pearl River Delta using mobile GPS data with complex network analysis and community detection (Gephi, NetworkX, Fast-unfolding algorithm)
- Explored the distribution of online medical records using complex network and clustering analysis
- Identified urban functional zones in Guangzhou and Foshan

2017 **Fusion of Sentinel optical and PolSAR data for land use and land cover mapping** (Class Project)
- Proposed an object-based refinement method to reduce the salt-and-pepper phenomenon and increase accuracy
- Evaluated the fusion of Sentinel Optical and PolSAR data using SVM, random forest, and neural network
- Published in *Remote Sensing* entitled *Integration of Convolutional Neural Networks and Object-Based Post-Classification Refinement for Land Use and Land Cover Mapping with Optical and SAR Data*

2017 **Community detection with open street map road network and graph theory** (Class Project)
- Developed a C++ program to calculate the shortest path using Dijkstra algorithm (linked list implementation)
- Developed a label propagation algorithm with real distance constraint for community detection
- Evaluated the performance of community detection by calculating modularity
- Visualized the detected road network community in ArcGIS

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