

# Bill Cai

Computer Vision Engineer, Data Scientist

## Work Experience

- Sep 2018  
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Present
- **Data Scientist, Computer Vision and Deep Learning**  
One Concern Menlo Park, California
    - One Concern is a benevolent AI company that provides trusted insights that positively impact our communities. Our mission is to drive deep social impact through benevolent intelligence to save lives and livelihoods.
    - Technical lead for in-house project to infer built environment and socio-economic features of cities using satellite images. Extensive use of Keras, Tensorflow, PyTorch for deep learning tools. Wrote and built Docker images, with deployment in Kubernetes clusters.
    - Coordinated data needs across seismic, flood and wildfire products, and provided technical oversight to deep learning efforts in wildfire prediction and flood modelling projects.
    - Customization of open-source Javascript/HTML/CSS image annotation libraries, and deployment on Apache servers on AWS, with integration to Amazon Mechanical Turk.
- Sep 2017  
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Sep 2018
- **Graduate Research Assistant, Computer Vision**  
MIT Senseable City Lab Cambridge, Massachusetts
    - Data mining and labelling, deep learning and computer vision models training, and large-scale deployment to quantify urban canopy cover and parking utilization on large city-wide scales
    - Sensor-fusion of lidar and camera data for obstacle detection in autonomous marine vehicle applications in Amsterdam and Boston/Cambridge
    - Implemented state-of-the-art CNN architectures for classification, semantic segmentation and instance segmentation, including residual network, Mask-RCNN, PSPNet. Utilized gradient class activation (Grad-CAM) maps to understand learned features
    - Extensive use of ROS, including Google Cartographer for SLAM, Velodyne lidar, IMU, USB cameras, for sponsored project by SNCF in Paris
- Jun 2017  
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Sep 2017
- **Summer Associate, Product Analytics**  
Thumbtack San Francisco, California
    - Built live dashboards with Python, R, SQL, Javascript/HTML/CSS to track key metrics
    - Modeled two-sided matching and dynamic marketplaces in Python. Our [engineering blog post](#) explains more!
    - Analyzed A/B test results to understand impact of product feature changes on customer behavior
    - Worked closely with product managers, engineers and designers to shape product decisions
- Jun 2016  
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Sep 2016
- **Intern, Social Programmes Directorate**  
Ministry of Finance Singapore
    - Completed an in-depth study of Singapore's in-depth voluntary retirement scheme and designed A/B testing of potential improvements. Presented findings to Permanent Secretaries
- Jun 2015  
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Sep 2015
- **Intern, Futures and Strategy Division**  
Ministry of Trade and Industry Singapore
    - Analyzed and investigated emerging strategic issues to inform strategic planning
- Jan 2014  
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Aug 2014
- **Business Development Lead**  
Arcstone Singapore
    - Led pitching and sourcing efforts, obtained a seven figure Series AA funding from VCs

## Education

- Sep 2017  
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Sep 2018
- **M.S. in Computation for Design and Optimization**  
Center for Computational Engineering, Massachusetts Institute of Technology Cambridge, Massachusetts
    - GPA: 5.00/5.00, thesis on applying computer vision and deep learning for large-scale quantification of urban and city dynamics (advised by [Carlo Ratti](#))
    - Selected Coursework: Advances in Computer Vision, Statistical Learning Theory and Applications, Numerical Methods in Partial Differential Equations, Optimization Methods
- Sep 2014  
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Jun 2017
- **B.A. in Economics**  
University of Chicago Chicago, Illinois
    - GPA: 3.87/4.00, Graduated with Phi Beta Kappa (highest honors) and Dean's List from 2014-2017
    - Selected Coursework: Planning, Learning and Estimation for AI, Machine Learning, Market Design, Inequality: A Perspective from Macroeconomics, Honors Econometrics, Applied Statistical Modeling

## Contact Info

Website and Projects:

[billcai.com](http://billcai.com)

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[me@billcai.com](mailto:me@billcai.com)

## Skills

Python  
Tensorflow, Keras, PyTorch  
Docker, Kubernetes  
Julia, MATLAB, R, Stata, SQL  
AWS (EC2, RDS, S3), AWS CLI  
ROS, C/C++  
Flask, HTML/CSS

## Interests

Coding, Programming  
Applied Mathematics  
(Optimization, Numerical PDEs)  
Economic Theory (Market  
Design, Computational Macro)  
Reading (Non-fiction)  
Basketball (Celtics)  
Football (Arsenal)

## Presentation and Talks

IEEE BigData Congress 2018  
Paper Presentation  
MIT CCE Student Seminar 2018

## Ongoing Research, Journal and Conference Publications

- Dec 2018 • Quantifying Legibility in Indoor Spaces Using Deep Convolutional Neural Networks: A Case Study in Train Stations  
*Submitted to Environment and Planning B: Planning and Design*  
Wang Zhoutong, Liang Qianhui, **Bill Yang Cai**, Louis Charron, Fabio Duarte, Carlo Ratti
- Dec 2018 • Deep Learning Architect: Classification for Architectural Design through the Eye of Artificial Intelligence  
*Submitted to Environment and Planning B: Planning and Design, [arXiv preprint](#)*  
Yuji Yoshimura, **Bill Yang Cai**, Wang Zhoutong, Carlo Ratti
- Aug 2018 • Deep Learning Based Video System for Accurate and Real-Time Parking Measurement  
*Submitted to IEEE Internet of Things Journal*  
**Bill Yang Cai**, Ricardo Alvarez, Michelle Sit, Fabio Duarte, Carlo Ratti
- Apr 2018 • Treepedia 2.0: Applying Deep Learning for Large-scale Quantification of Urban Tree Cover  
*Published in IEEE BigData Congress 2018, [arXiv preprint](#)*  
**Bill Yang Cai**, Xiaojiang Li, Ian Seiferling, Carlo Ratti
- Feb 2018 • Using Street-level Images and Deep Learning for Urban Landscape Analysis  
*Published in Landscape Architecture Frontiers*  
Xiaojiang Li, **Bill Yang Cai**, Carlo Ratti

## Research Projects

- Sep 2017 | Sep 2018 • [Treepedia](#)  
*Role: Computer Vision and Deep Learning Lead*  
Treepedia is a project by the MIT Senseable City Lab in partnership with the World Economic Forum to measure canopy cover and green spaces in cities globally. This project has inspired planners and policymakers to design greener cities, and has been featured on the [Wall Street Journal](#), [Time](#), [Wired](#), and [Forbes](#). I developed the Tensorflow-based deep learning algorithms used to detect and quantify canopy cover from Google Street View images, from data annotation to model training/hyperparameter tuning to eventual [trained model/library](#).
- Jan 2018 | Sep 2018 • [Roboat](#)  
*Role: Computer Vision Engineer*  
Roboat is a 5 year research project and collaboration between the Amsterdam Institute for Advanced Metropolitan Solutions and MIT to develop the world's first fleet of urban autonomous floating vessels. Our project has been featured on [CNBC](#), [The Verge](#), [Reuters](#), [Quartz](#), and [Fortune](#). I tuned and deployed Tensorflow-based instance segmentation and object detection models on boat-based GPUs/mini PCs to detect live obstacles, and provide estimated obstacle locations and types to the ROS-based motion planner.
- Apr 2018 | Sep 2018 • [Space Legibility](#)  
*Role: Robotics and Computer Vision Lead*  
Space Legibility is a 2 year project between SNCF, France's national state-owned railway company, and MIT to investigate the interactions between space design and commuter usage in train stations based in Paris. I adapted [Google's ROS-based Cartographer library](#) which uses our lab's Velodyne VLP16 Lidar and IMU, in order to provide dense 3D maps of train stations in Paris (Gare De Lyon, Gare St Lazare) as well as MIT's famous infinite corridor.