Bill Cai

Machine Learning, Computer Vision, Computational Science

Education

Sep 2017 | Sep 2018

M.S. in Computational Science and Engineering

Center for Computational Science and 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 PhD-level Coursework: Advances in Computer Vision (w A Torralba and B Freeman), Statistical Learning Theory and Applications (w T Poggio, L Rosasco), Numerical Methods in Partial Differential Equations (w Wang Qiqi)
- Completed necessary coursework and research thesis in one year (for government scholarship purposes) that is typically completed in two years.

Sep 2014 | 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 PhD-level Coursework: Planning, Learning and Estimation for AI (w M Walter), Market Design (w E Budish, M Akbarpour), Inequality: A Perspective from Macroeconomics (w Greg Kaplan)
- Completed undergraduate coursework in 3 years, instead of the usual 4 years and graduated with academic honors and Dean's List for all years.

Work Experience

Sep 2019 | Present

Data Scientist

Data Science and AI Division, Government Technology Agency

Singapore

- Govtech Singapore is the technology arm of the Singapore government. The Video Analytics team works on developing and deploying computer vision and video understanding models for social good.
- Lead for AI modelling efforts in few-shot object detection, video activity recognition, and captioning models. Deployed and implemented using REST APIs in Python, with K8s backends for infrastructure abstraction.
- Tech lead on 24/7 COVID-19 crowd analytics project for 200+ cameras deployed on AWS. Designed and implemented full Terraform infrastructure-as-code, serverless architecture using AWS Lambda, API Gateway, and cloud-native solutions including AWS Rekognition, S3, ECR, API Gateway.
- Main cloud architect and DevSecOps lead for large-scale end-to-end cloud-native computer vision platform for image and video analytics. Designed fully security-compliant system, and main representative for successfuly completed 3rd party security assessment for IM8 and security risk assessment.
- Extensive use and knowledge of cloud-native tools, as well as building customised toolkits around them. Including customised Kubernetes jobs for video analytics, automating Docker image vulnerability scans as part of CICD pipelines, secure authentication for frontend automation testing.

Sep 2018 | Sep 2019

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.
- Lead in-house inference of key features from unstructured data. Extensive use of Keras, Tensorflow, PyTorch to build deep learning tools. Wrote and built Docker images, with deployment in Kubernetes.
- 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 | 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

Contact Info

Website and Projects:

billcai.com

LinkedIn Profile:

linkedin.com/in/billcai77

Email Address:

me@billcai.com

Skills

Python, Javascript, C++
Tensorflow, Keras, PyTorch
Docker, Kubernetes
Julia, MATLAB, R, Stata, SQL
Terraform, Selenium, Serverless
Certified AWS Solutions Architect Professional
Certified AWS DevOps Engineer

Interests

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

Academic Service/Talks

NeurIPS 2020 Climate Change AI Program Committee
ICLR 2020 Climate Change AI Program Committee
Reviwer for CVPR 2021, NeurIPS 2020, ICLR 2020
MIT Computational Science and Engineering Student Seminar 2018

Ongoing Research, Journal and Conference Publications

Dec 2020 — SB-MTL: Score-based Meta Transfer-Learning for Cross-Domain Few-Shot Learning
arXiv preprint
John Cai, **Bill Yang Cai**, Shengmei Shen

Oct 2019 — Quantifying Urban Canopy Cover with Deep Convolutional Neural Networks
Published in *NeurIPS Workshop on Climate Change AI*
Bill Yang Cai, Xiaojiang Li, Carlo Ratti

Aug 2018 — Deep Learning Based Video System for Accurate and Real-Time Parking Measurement
Published in *IEEE Internet of Things Journal*
Special Issue on Enabling a Smart City: Internet of Things Meets AI
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

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.