

## Dr Chen Tao

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### Research Interest

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Computer vision, (Multidimensional) data analytics, machine learning and pattern recognition.

### Education

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**PhD** in Information Engineering, **Nanyang Technological University**, Singapore 2008 – 2013  
CGPA: 4.5 / 5.0

Thesis title: Content and Context Analysis for Mobile Landmark Recognition, funded by A\*STAR Grant worth SGD 500,000

Summary: This thesis focuses on mobile-based landmark recognition which uses camera phone to capture a landmark and determine its related information such as its name, history and activities. Several feature extraction and machine learning techniques are developed to address this issue, which include using GPS and direction to supervise image discriminative information extraction and recognition.

**M.Eng** in Electronic Engineering, **Zhejiang University**, China 2006 – 2008  
Rank: Top 10%

Thesis title: PFV-ATM System based on Face, Voice and Password, funded by Zhejiang Province Science and Technology Agency worth Chinese Yuan RMB 270,000.

Summary: This thesis focuses on human identity verification based on speaker and face recognition. The voice and face of each person are used to learn a model respectively, and then integrated together with the password to verify the person's identity.

**B.Sc** in Electronic Engineering, **Shandong University**, China 2002 – 2006  
Rank: Top 10%

Thesis title: Infusion Drip Monitoring System

### R&D Experiences

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#### Institute: Fudan University

- Feb 2019 – Now
- Role: Tenure\_track Professor
- Lead a team of 10-20 people including PhDs, Masters and Bachelors to focus on studies of deep learning based computer vision applications.

#### Company: Huawei Singapore Research Center, Singapore

- Aug 2017 – Feb 2019

- Role: Senior Computer Vision and Machine learning Scientist
- Key responsibility: Participate into the fundamental R&D in computer vision and machine learning research field, and apply these solutions into the Huawei chipset products, which include:
  - (1) Develop deep learning based traffic monitoring algorithms from videos for intelligent transportation
  - (2) Develop vehicle and pedestrian detection algorithm using deep learning method
  - (3) Develop SLAM and stereo vision algorithm for camera movement estimation
- Tools: Python, C++, Matlab, Caffe, OpenCV Library

**Company: Agency for Science, Technology and Research (A\*STAR), Singapore** ➤ Dec 2013 – Jul 2017 **Institute for Infocomm Research (I2R)**

- Role: Machine learning and Computer Vision Research Scientist (**Promoted to be Scientist II since Apr 2017**)
  - Key responsibility: Participate into a set of Singapore Smart Nation projects including:
    - ✓ **Mobile scene text spotting for elderly based on deep learning**, with MoH, Singapore
    - ✓ **Illegal parking detection project** (worth SGD 270,000) with URA and NCS, Singapore
    - ✓ **Traffic sign recognition module for Autonomous Vehicle project** (worth SGD 18,000,000) and do research related to mobile enforcement, intelligent transportation, autonomous vehicle, UAV environment monitoring and scene text recognition including:
      - (1) Design deep learning algorithms for object detection and recognition from mobile video and image data for customers
      - (2) Design video data mining and analytics algorithms to find abnormal events
      - (3) Implement algorithm prototype and demonstration to customers
      - (4) Write projects reports and present to customers
      - (5) Prepare paper publications and file patents to protect the intellectual property
  - Tools: Python, C++, Matlab, Caffe, OpenCV Library
- May 2013 – Nov 2013 **Advanced Remanufacturing and Technology Center (ARTC)**
- Role: Development Scientist
  - Key responsibility: Participate into the collaborative project: “Intelligent Aerospace Engine Material Removal” with SGD 100,000 with Rolls Royce, IHI, Siemens and local SMEs to find the key problems and matching points aiming to improve their productivity, which includes:
    - (1) Design image defect detection algorithm for aerospace product manufacturing verification
    - (2) Design manufacturing data analytics algorithms for user decision making
    - (3) Design multi-sensor data collection and fusion algorithms to monitor industry manufacturing process
    - (4) Write project and funding proposals, projects delivery reports and present to customers
  - Tools: LabView, C, Python, Matlab

**Company: Nanyang Technological University, Singapore** ➤ Oct 2012 – Apr 2013 **Intelligent Robotics Research Lab**

- Role: Research Associate
- Key responsibility: Participate into the collaborative projects related to marine safety, monitoring and inspection with local public sectors such as Singapore National Defense and Singapore Maritime Port Authority to provide intelligent technical support, which include:
  - (4) Develop landmark image processing and recognition algorithm for mobile robot navigation and coastal environment mapping
  - (5) Develop 3D laser ranger data analytics for data registration

- (6) Collect experimental data and prepare test scenarios
- (7) Write project and funding proposals
- Tools: C++, Matlab, OpenCV Library

### Company: Motorola Inc., Hangzhou, China

- Summer 2007 Graphics User Interface Design Group
  - Role: Software Engineer Intern
  - Key responsibility: Participate into multiple TV box development projects including:
    - (1) Develop GUI of Set-top boxes for HDTV,
    - (2) Participate in the bidding process of “Nanjing Panda” project
    - (3) Conducting a survey on the marketing requirements of HDTV and preparing related documents.
    - (4) Implementation of Graphics User Interface and encapsulation of middle-ware SDK function
  - Tools: C++, ucGUI toolbox

### Awards & Honors

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- School Dean Award at Fudan University, 2021.
- Promotion to be Staff Engineer in Nov 2017 due to contribution to Huawei AI chipsets.
- Promotion to be **Scientist II** in Apr 2017 due to excellent R&D contribution to I2R.
- Top Performers of I2R (**Ranked Top 15%** among 30 research scientists in Visual Computing department in 2016 staff Annual Performance Appraisal), Jan 2017
- RIE2020 Contribution Award by Executive Director of I2R
- Top of Top Performers of I2R (**Ranked No. 2** among 30 research scientists in Visual Computing department in 2015 staff Annual Performance Appraisal), Jan 2016
- Top of Top Performers of I2R (**Ranked No. 1** among 50 research scientists in Visual Computing department in 2014 staff Annual Performance Appraisal), Jan 2015.
- ICIP Conference Travel Grant by the IEEE Signal Processing Society, July 2011.
- Excellent Graduate Thesis Awarded by Zhejiang University, July 2008.
- First Prize of Zhejiang University Challenge Cup Academic Competition, Apr 2008.
- Excellent Student Scholarship by Shandong University, Aug 2003 - Aug 2005.
- Third Prize in National High School Mathematic League Competition, Sep 2001.
- Second Prize of Chemistry Olympiad Shandong Province, Sep 1999.

### Professional Activities

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- Present “Mobile visual analysis” tutorial at CVPR 2021.
- Present “Semi-supervised CNN” in VCC workshop Yinchuan, China, 2019
- Presenter in International Security and Surveillance Expo, Shenzhen, China, Oct 2017.
- Presenter in IEEE International Conference on Image Processing (ICIP), Quebec, Sep 2015.
- Presenter in IEEE International Conference on Image Processing (ICIP), Belgium, Sep 2011.
- Presenter in International Conference on Information, Communication, and Signal Processing (ICICS), Singapore, Dec 2011.

- Student helper in IEEE International Conference on Multimedia & Expo (ICME), Singapore, Jul 2010.
- Invited talk in Zhejiang University, Hangzhou, China, Dec 2008.
- Presenter in International Conference on Image and Graphics (ICIG), Chengdu, China, Aug 2007.

### Teaching Experiences

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- Computer Vision, Graduate course.
- Image Processing and Machine Vision, Undergraduate course for Year 3, Semester Fall.
- Supervise a PhD student in I2R whose topic is text detection, recognition, 2015-2016.
- Supervise research attachment students from local universities (NTU, NUS) for their thesis completion, 2013-2015.
- Supervise Final Year Project students in NTU for their bachelor thesis, Fall 2009-Fall 2011.
- Teaching Assistant for courses: EE2071 in NTU. Help undergraduate students for Matlab programming exercises, Fall 2011.
- TA for course FE1008, NTU. Help undergraduate students for C programming exercises, Fall 2010.
- Supervise bachelor students from Zhejiang University for their bachelor thesis completion, 2007.

### Programming Skills

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C, C++, Python, Matlab, VB, Java, SQL, Labview, VHDL, Verilog HDL.

### Referred Research Publications

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**Journal Papers (IEEE Trans on PAMI, CSVT, TMM, SMC, VT, TGRS, IS, etc.):**

**Published:**

- [J28] B. Zhang, **T. Chen**, B. Wang, "Curriculum-style Local-to-global Adaptation for Cross-domain Remote Sensing Image Segmentation," in press, *IEEE Transactions on GeoScience and Remote Sensing (T-GRS)*, 2022.
- [J27] M. Zhu, J. Fan, Q. Yang, **T. Chen**, "A Self-supervised Contrastive Efficient Asymmetric Dilated Network for Hyperspectral Image Classification," in press, *IEEE Transactions on GeoScience and Remote Sensing (T-GRS)*, 2022.
- [J26] Y. Liao, H. Zhu, C. Ye, G. Zhang, **T. Chen**, "Point Cloud Instance Segmentation with Semi-supervised Bounding-Box Mining," in press, *IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI)*, 2022.
- [J25] B. Zhang, **T. Chen**, B. Wang, "Joint Distribution Alignment via Adversarial Learning for Domain Adaptive Object Detection," in press, *IEEE Transactions on Multimedia (T-MM)*, 2021.
- [J24] B. Zhang, **T. Chen**, X. F. Wu, L. M. Zhang, J. Fan, "Densely Semantic Enhancement for Domain Adaptive Region-free Detectors," in press, *IEEE Transactions on Circuits and Systems for Video Technology (T-CSVT)*, 2021.

- [J23] X. Qian, H. Fu, W. Shi, **T. Chen**, Y. Fu, F. Shan, X. Xue, "M3Lung-Sys: A Deep Learning System for Multi-Class Lung Pneumonia Screening from CT Imaging," in press, *IEEE Journal of Biomedical and Health Informatics (JBHI)*, 2020.
- [J22] J. Fan, **T. Chen**, F. Zhou, "A Bottom-Up Approach for Robust Spotting of Texts in Scenes," in press, *Journal of Visual Communication and Image Representation (JVCIR)*, 2020.
- [J21] F. Zhou, S. Kong, C. C. Fowlkes, **T. Chen**, B. Lei, "Fine-Grained Facial Expression Analysis Using Dimensional Emotion Model," *Neurocomputing*, vol. 392, pp. 38-49, 2020.
- [J20] **T. Chen**, S. Lu, J. Fan, "Semi-supervised hierarchical CNN for image classification," *IEEE Trans on Image Processing (T-IP)*, in press, 2019.
- [J19] **T. Chen**, S. Lu, J. Fan, "Subcategory-aware CNN for object detection," *IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI)*, DOI:10.1109/TPAMI.2017.2756936, in press, 2018.
- [J18] J. Y. Fan, **T. Chen\***, "Deep Sparse Coding Learning for Spectral-Spatial Hyperspectral Image Classification," *IEEE Transactions on Circuits and Systems for Video Technology (T-CSVT)*, in press, 2017. (\* denotes corresponding author)
- [J17] **T. Chen**, S. Lu, "Subcategory-aware feature selection and SVM optimization for UAV based oil spill detection," *IEEE Transactions on GeoScience and Remote Sensing (T-GRS)*, vol.55, no. 9, pp. 5264-5273, 2017.
- [J16] J. Y. Fan, **T. Chen**, S. Lu, "Unsupervised Feature Learning For Land-Use Scene Recognition," *IEEE Transactions on GeoScience and Remote Sensing (T-GRS)*, vol.55, no.4, pp.2250-2261, 2017.
- [J15] **T. Chen**, S. Lu, "Object-level motion detection from moving optic cameras," *IEEE Transactions on Circuits and Systems for Video Technology (T-CSVT)*, vol.27, no.11, pp. 2333-2343, 2017.
- [J14] **T. Chen**, S. Lu, "Accurate and Efficient Traffic Sign Detection Using Discriminative Adaboost and Support Vector Regression," *IEEE Transactions on Vehicular Technology (T-VT)*, vol.65, pp. 4006 - 4015, 2016.
- [J13] **T. Chen**, S. Lu, "Robust vehicle detection and viewpoint estimation with soft discriminative mixture mode," *IEEE Transactions on Circuits and Systems for Video Technology (T-CSVT)*, vol.27, no. 2, pp. 394-403, 2017.
- [J12] J. W. Cao, **T. Chen**, J. Y. Fan, "Landmark Recognition with Compact BoW Histogram and Ensemble ELM," *Multimedia Tools and Applications (MTAP)*, pp. 1-19, 2015.
- [J11] J. Y. Fan, **T. Chen**, C.C. Kot, "EXIF-white balance recognition for image forensic analysis," *Multidimensional Systems and Signal Processing (MSSP)*, pp. 1-21, 2016.
- [J10] **T. Chen**, S. Lu, J. Y. Fan, "Context-Aware Vocabulary Tree for Mobile Landmark Recognition," *Journal of Visual Communication and Image Representation (JVCIR)*, vol. 30, pp. 289-298, 2015.
- [J9] **T. Chen**, K.-H. Yap, "Discriminative Soft Bag-of-Visual Phrase for Mobile Landmark Recognition," *IEEE Transactions on Multimedia (T-MM)*, vol. 16, pp.612-622, Apr 2014.
- [J8] **T. Chen**, K.-H. Yap, "Context-Aware Discriminative Vocabulary Learning for Mobile Landmark Recognition," *IEEE Transactions on Circuits and Systems for Video Technology (T-CSVT)*, vol.23, pp. 1611 - 1621, 2013.
- [J7] **T. Chen**, K.-H. Yap, "Discriminative BoW Framework for Mobile Landmark Recognition," *IEEE Transactions on Systems, Man and Cybernetics (T-SMC), Part B*, vol. 44, pp. 695-706, 2013.
- [J6] S. Lu, **T. Chen**, S. Tian, J.-H. Lim, T.- C. Lim, "Scene Text Extraction based on Edges and Support Vector Regression," *International Journal on Document Analysis and Recognition (IJ DAR)*, vol. 18, pp. 125-135, 2015.

- [J5] T. Chen, K.-H. Yap, and L.-P. Chau, "Integrated Content and Context Analysis for Mobile Landmark Recognition," *IEEE Transactions on Circuits and Systems for Video Technology (TCSVT)*, vol. 21, pp. 1476 - 1486, 2011.
- [J4] K.-H. Yap, T. Chen, Z. Li, and K. Wu, "A Comparative Study of Mobile-based Landmark Recognition," *IEEE Intelligent Systems (IS)*, vol. 25, no.1, pp. 48-57, 2010. (First Author is PhD supervisor)
- [J3] T. Chen, Z. G. Fang, J. Xu, "A Multi-Channel Identity Verification System based on Face and Voice," *Journal of Shandong University (Engineering Science)*, vol. 38, no. 2, pp. 56-60, 2008.
- [J2] T. Chen, Z. G. Fang, J. Xu, "A Speaker Identity System based on Verification Mode," *Journal of Ergonomics*, vol. 14, no. 1, pp. 42-44, 2008.
- [J1] Z. P. Lin, J. W. Cao, T. Chen, "Extreme Learning Machine on High Dimensional and Large Data Applications," *Mathematical Problems in Engineering*, pp. 1-2, 2015.

#### Conference Papers (IEEE ICASSP, ICIP, VCIP, etc.)

- [C20] Y. Wu, B. Zhang, G. Yu, W. Zhang, B. Wang, T. Chen, "Object-aware Long-short-range Spatial Alignment for Few-Shot Fine-Grained Image Classification," in press, *ACM Conference on Multimedia (ACM MM)*, Chengdu, China, 2021.
- [C19] Q. Yang, T. Chen, J. Fan, Y. Lu, C. Zuo, Q. Chi, "EADNET: Efficient Asymmetric Dilated Network For Semantic Segmentation," in press, *IEEE ICASSP*, 2021.
- [C18] J. Chen, J. Zhang, E. Sangineto, T. Chen, F. Jia, N. Cebe, "Coarse-to-Fine Gaze Redirection with Numerical and Pictorial Guidance," in press, *IEEE Winter Conference on Applications of Computer Vision (WACV)*, 2021.
- [C17] J. Sun, J. Chen, T. Chen, J. Fan, S. He, "PIDNet: An Efficient Network for Dynamic Pedestrian Intrusion Detection," in press, *ACM Conference on Multimedia (ACM MM)*, Seattle, Washington, USA, 2020.
- [C16] R. Wu, G. Zhang, S. Lu, T. Chen, "Cascade EF-GAN: Progressive Facial Expression Editing with Local Focuses," IEEE International Conference on Computer Vision and Pattern Recognition (*CVPR*, Oral), Seattle, Washington, 2020.
- [C15] T. Chen, S. Lu, "DPM REVISITED: Utilizing Root-Part Spatial Distribution For Vehicle Viewpoint Estimation," *IEEE International Conference on Image Processing (ICIP Oral Presentation, Oral acceptance rate: 8%)*, pp.2169-2173, Sep. 2015.
- [C14] T. Chen, S. Lu, "Context-Aware Lane Marking Detection On Urban Roads," *IEEE International Conference on Image Processing (ICIP Poster Presentation)*, pp. 2557-2561, Sep. 2015.
- [C13] J. Fan, T. Chen, S. Lu, "Vegetation Coverage Detection from Very High Resolution Satellite Imagery," *IEEE International Conference on Visual Communications and Image Processing (VCIP, Oral Presentation)*, in press, Singapore, Dec. 2015.
- [C12] J. Fan, T. Chen, "Reversible Watermarking Using Enhanced Local Prediction," *IEEE International Conference on Image Processing (ICIP, Poster)*, In press, Sep. 2015.
- [C11] J.W. CAO, Y.F.ZHAO, X.P. LAI, T. Chen, "Landmark Recognition via Sparse Representation," *IEEE International Conference on Digital Signal Processing (DSP, Oral Presentation)*, pp. 1030-1034, 2015.
- [C10] J. Fan, T. Chen and J.W. Cao, "Image Tampering Detection Using Noise Histogram Features," *IEEE International Conference on Digital Signal Processing (DSP, Oral Presentation)*, pp.1044-1048, 2015.

- [C9] J.W. Cao, **T. Chen**, J. Y. Fan, "Fast Online Learning Algorithm for Landmark Recognition based on BoW Framework," *IEEE Conference on Industrial and Electronics Applications (ICIEA)*, pp. 1163-1168, 2014.
- [C8] **T. Chen**, J. Fan, S. Lu, "Context-aware codebook learning for mobile landmark recognition," *IEEE International Conference on Image Processing (ICIP, oral presentation, oral acceptance rate < 10%)*, pp. 3963-2967, 2014.
- [C7] **T. Chen**, K.-H. Yap, and D. J. Zhang, "Discriminative Bag-of-Visual Phrase Learning for Landmark Recognition," *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP, Oral Presentation, Oral rate < 10% )*, pp. 893-896, Kyoto, Japan, Mar. 2012.
- [C6] **T. Chen**, K.-H. Yap, and L.-P. Chau, "Content and Context Information Fusion for Mobile Landmark Recognition," *International Conference on Information, Communications and Signal Processing (ICICS, Oral Presentation)*, pp. 1-4, Singapore, 2011.
- [C5] **T. Chen**, K.-H. Yap, L.-P. Chau, "From Universal Bag-of-Words to Adaptive Bag-of-Phrase for Scene Recognition," *IEEE International Conference on Image Processing (ICIP, Poster)*, pp.841-884, Brussels, Belgium, Sep. 2011.
- [C4] **T. Chen**, K.-H. Yap, L.-P. Chau, "A Discriminative Learning Approach for Mobile Landmark Recognition," *IEEE International Conference on Image Processing (ICIP, Poster)*, pp. 217-220, Brussels, Belgium, Sep. 2011.
- [C3] **T. Chen**, Z. Li, K.-H. Yap, K. Wu, and L.-P. Chau, "A Multi-scale Learning Approach for Landmark Recognition Using Mobile Devices," *International Conference on Information, Communications and Signal Processing (ICICS, Oral)*, pp.1-4, Macau, 2009.
- [C2] **T. Chen**, K. Wu, K.-H. Yap, Z. Li, and F. S. Tsai, "A Survey on Mobile Landmark Recognition for Information Retrieval Systems," *MDM International Workshop on Mobile Media Retrieval (Oral presentation)*, pp.625-630, Taipei, Taiwan, May 2009.
- [C1] Y. Zhao, J. Cao, X. P. Lai, **T. Chen**, "Ensemble based Constrained-Optimization Extreme Learning Machine for Landmark Recognition," *Proceedings of The 34rd Chinese Control Conference (CCC2015, Oral)*, pp. 3884-3889, 2015.

## Patents

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### Filed:

- [P1] T. Chen, S.Lu, "Accurate and Efficient Traffic Sign Detection," P2014003/SG, Singapore. Recommend for US patent filing application.
- [P2] T. Chen, S.Lu, "Object-Level Motion Detection from Moving Cameras," TD2015034, filed, Singapore.
- [P3] T. Chen, S. Lu, "Oil spill detection based on UAV images," 2016.
- [P4] T. Chen, S. Lu, "Deep Hierarchical CNN for Vehicle Type Classification," 2017.