Tzu-Ching Wu (George)

E-Mail: Tzu-ching.Wu@Sartorius.com
Research website: http://tzuching1.weebly.com/

Advanced Algorithm Development, Image Processing Engineer at Sartorius

Professional overview

- 7 imaging software development, 9 journal publications and one selected as journal cover article, 9 conference publications in Image processing, Computer vision, Artificial Neural network, and Multi-objective optimization fields.
- 3+ years of Industrial software development experience working on image enhancement, feature recognition, semantic and panoptic segmentation, object detection and tracking, GANs, and AI model optimization, compression, and deployment with C++.
- Developed novel wavelet-based imaging segmentation algorithm and 3D cell tracking method and collaborated with four labs to develop imaging software to analysis fluorescence microscopy, two-photon calcium imaging, smFISH expression in PhD period.
- Strong software development/programming skills and multidisciplinary research experiences in fields from Deep learning, Neural network optimization, Multi-objective optimization to Numerical simulation method.

Research fields

Medical imaging processing, Deep learning, Computer Vision, Multi-objective optimization.

Research expertise

Programming: Python(6 years), C++(3 years), MATLAB(12 years), Pytorch, OpenCV, Git, COMSOL, AMOS, Linux

Computational Modeling: Image processing, Deep learning, Artificial Neural Network, Heuristic Algorithm, Numerical method, Fuzzy logic, Multi-objective optimization, Heuristic Algorithm, Multivariate statistical analysis

Software development: WaveletSEG, ZebEmbIM, Lobefinder, CCRIT, Neuronal CalciumIM, CytonemeSIM

Experience

Advanced Algorithm Development, Image Process Engineer   **Sep 2019 to Current**
Sartorius Stedim North America – Ann Arbor, MI

- Maintain and optimize reliable production-quality C++ code for Live Cell Analysis Systems IncuCyte.
- Develop and train the AI segmentation module in PyTorch and deploy the ONNX model to C++ code. Also working on encryption/decryption of AI model and neural network structure optimization and compression.
- Develop and implement image enhancement, feature recognition, image registration, calibration, tracking and segmentation algorithms for cell microscopy image using C++.
- Built 2D cell tracking algorithm platform and investigate AI-based tracking prototype model.
- Design and develop prototype models and tools using Python and MATLAB to assist algorithm development and algorithm testing analyze, data quality control and test design.

Ph.D. Research Assistant   **Sep 2012 to Sep 2019**
Umulis lab, Purdue University - West lafayette, IN

- Developed Novel wavelet segmentation and tracking algorithm and built automatically imaging analysis platform: **WaveletSEG**
- Established comprehensive imaging analysis platform including nuclei, mRNA, and membrane segmentation: **ZebEmbIM**
- Designed pavement cell morphogenesis analysis method and software and selected as journal cover article: **Lobefinder**
- Built Cell-by-Cell Relative Integrated Transcript (**CCRIT**) software to identify cells clusters and mRNA expression level.
- Developed neuronal calcium fluorescence spatio-temporal analysis software: **Neuronal CalciumIM**
- Designed the first cytoneme-mediated morphogen transport mathematics model and simulation tool: **CytonemeSim**
- Built deep learning object detection and semantic segmentation prototype model for chest X rays lung cancer screening.

Research Assistant   **Sep 2009 to June 2012**
Wu Lab, Yang-Ming University - Taipei, Taiwan

- Developed peak detection algorithm for bioinformatic mass spectrometry analysis using continuous wavelet transform.

Research Assistant   **Sep 2006 to June 2009**
Wu Lab, Chang Lab, Taiwan University - Taipei, Taiwan

- Incorporated multi-objective optimization NSGAII and multivariate statistical method to optimize water resources management.
- Image Processing for river grain-size distribution estimating using artificial neural networks.
- Performed artificial neural networks for Arsenic variation estimation in the regional ground water.
- Applied self-organizing radial basis (RBF) neural networks to estimate riverine biodiversity.

Education and award

Ph.D. in Agricultural and Biological Engineering, Purdue University, USA, 2012 - Present
M.S. in Bioenvironmental Systems Engineering, National Taiwan University, 2006 - 2008
B.S. in Chemistry, National Tsing Hua University, Taiwan, 1994 – 2000
Award: Agricultural Engineering Research Center Scholarship Award, 2007

Publications

Journal papers (select):

1. **Tzu-Ching Wu**, Xu Wang, Linlin Li, Ye Bu, David Umulis. Automatic wavelet-based 3D nuclei segmentation and analysis for multicellular embryo quantification. Scientific reports, 11.1 (2021), pp. 1-13. (SCI)

2. **Tzu-Ching Wu**, Samuel Belteton, Jessica Pack, David Umulis, Daniel B. Szymanski, LobeFinder: a convex hull-based method for quantitative boundary analyses of lobed plant cells. Plant Physiology, 171.4 (2016): 2331-2342. (* Selected as cover article)

3. Pharris, M. C., **Wu, T. C.**, Chen, X., Wang, X., Umulis, D. M., Weake, V. M., & Kinzer-Ursem, T. L. (2017). An automated workflow for quantifying RNA transcripts in individual cells in large data-sets. MethodsX. (SCI)

4. Chang, F.J., Tsai, W.P., **Wu, T.C.**, Chen, H.K., and Herricks, E.E, 2011. Identifying natural flow regimes using fish communities. Journal of Hydrology, 409 (1-2), pp. 328-336. (SCI)

5. Chang F.J., **Wu T.C.**, Tsai W.P., and Herricks E.E., 2009. Defining the ecological hydrology of Taiwan Rivers using multivariate statistical methods. Journal of Hydrology, 376 (1-2), pp. 235-242. (SCI)

Conference papers (select):

1. **Wu, T. C.,** Wang, X., & Umulis, D. M, 2019. Ground Truth Annotator and 3D Dataset Generator for Validation of Nuclei Segmentation Programs. In 2019 12th International Congress on Image and Signal Processing, BioMedical Engineering and Informatics (2019 CISP-BMEI) (pp. 1-4). IEEE.

2. Xu Wang, **Tzu-Ching Wu,** Linlin Li, Bobby Madamanchi, Ye Bu and David Umulis, 2020. Quantitative imaging in zebrafish traces noise propagation in BMP signaling. 2020 Cellular and Molecular bioengineering conference (2020 CMBE).

3. Linlin Li, Xu Wang, **Tzu-Ching Wu**, Adrian Buganza-Tepole and David Umulis, 2020. Integrating Dynamic Cell Imaging Data into Moving Mesh Finite Element Models of Developing Zebrafish Embryos. 2020 Cellular and Molecular bioengineering conference (2020 CMBE).

4. Nimisha Bajaj, **Tzu-Ching Wu**, Sherry L. Voytik-Harbin, David M. Umulis, Ann E. Rundell, 2015. Regulation of Integrin Activation in Neovascularization by Basement Membrane Proteins and Inhibitors, Purdue BMEs poster, West lafayette. USA

5. **Tzu-Ching Wu**, and David M. Umulis, 2014. Development of a new approach for early Drosophila embryos BMP signaling pathway identification using Fuzzy logic based optimization and Fuzzy inference system, ABE Graduate Symposium, USA

6. **Tzu-Ching Wu**, Samuel Belteton, John Mason, Daniel B. Szymanski, and David M. Umulis, 2013. Quantitative image analysis and identification of symmetry breaking events during pavement cell morphogenesis in Arabidopsis thaliana, Midwest Plant Cell Dynamics Meeting, Madison. USA