Qiang Zhu

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EDUCATION

Ph.D. Electrical & Computer Engineering, University of Maryland, College Park — College Park, MD
Advised by *Prof. Min Wu*, GPA: 3.8/4.0 — December 2019 (Expected)
Selected Courses: *Machine Learning*, *Adaptive Signal Processing*, Digital Image Processing, Linear Model, Real Analysis, Digital Communication.

M.S. Electrical Engineering, Shanghai Jiaotong University — Shanghai, China
Advised by *Prof. Jianxun Li*, GPA: 3.7/4.0 — March 2014

B.S. Electrical Engineering, Zhejiang University — Hangzhou, China
Top 10%, GPA: 3.7/4.0 — July 2010

PROFESSIONAL EXPERIENCE

Entrepreneurial Lead, NSF National I-Corps Program — Detroit, MI
Received $50,000 on market analysis and commercialization potential (*remote* cardiac sensing). — August–December, 2018

Video & Image Research Intern, Dolby Laboratories — Sunnyvale, CA
Developed a patent pending HDR image enhancement algorithm (*integrated to DoVi encoder SDK in 2018*). — May–August, 2017

TEACHING EXPERIENCE AT UMD

ENEE 630 (Advanced Digital Signal Processing); ENEE 631 (Digital Image and Video Processing).

ENEE 322 (Signal and System Theory); ENEE 324 (Engineering Probability).

ENEE 222 (Elements of Discrete Signal Analysis); ENEE 245 (Digital Circuits and Systems Laboratory).

COMPUTING SKILLS

Languages: Python, MATLAB, C/C++, SQL.
Tools: LaTeX, Git, Scikit-learn, Tensorflow, Spark, Adobe Illustrator/Photoshop.

RESEARCH PROJECTS AT MEDIA AND SECURITY TEAM (MAST), UMD

Remote Vital Signs Monitoring Using Regular RGB Camera — From July 2016

— Proposed a dense optical-flow based motion estimation scheme for fine-grained human face registration and enabled highly-accurate remote extraction of human vital signs (e.g., heart rate, heart rate variability, and breathing rate) in realtime using regular RGB camera in exercise or driving scenarios.
— Designed and built a Python prototype with ResNet-based face detector/tracker and adaptive cardiovascular signal processing units and achieved the state-of-the-art performance of less than 1 bpm in estimation error.
— Proposed an unsupervised online learning scheme for efficient subject-specific and scene-tailored skin detection and improved the overall accuracy of heart rate estimation by 20%.
— Proposed a novel adaptive filtering algorithm and achieved more than 40% improvement in estimation accuracy of the heart rate variability.

Electrocardiogram (ECG) Reconstruction From Photoplethysmogram (PPG) — From June 2018

— Carried out a detailed statistical modeling of the two related cardiovascular measurement (ECG and PPG) with deep bio-insights and high model interpretability.
— Devised a novel semi-couple dictionary learning algorithm for inversely reconstruct the ECG signals from the more easily obtainable PPG signals and improved the diagnostic capability of the PPG signals by more than 50%.
— Verified the efficacy of the proposed model using both public-available and self-collected databases with 147 subjects with a variety of age, weight, and disease types.

Robust Frequency Tracking Weak Signal Traces Under Severe Noise and Distortions — May 2017–September 2018

— Proposed an iterative dynamic programming algorithm and enabled the tracking of multiple frequency components in a highly corrupted signal of less than -10 dB at a error rate of less than 4%.
— Extensive experiment results on real-world digital forensic data demonstrate more than double of the estimation accuracy with no additional computational cost compared with the state-of-the-art methods.
— Implemented and evaluated the state-of-the-art approaches such as Factorial HMM, particle filter, and spectral clustering based algorithms.

Electrical Network Frequency (ENF) Estimation From Multimedia Data — May–December 2016

— Assisted in building and testing an ENF estimation prototype for extracting the subtle ENF signals from the multimedia contents.

Publication

J1 A. Hajj-Ahmad, C.-W. Wong, . Gambino, **Q. Zhu**, M. Yu, and M. Wu, "Factors Affecting ENF Capture in Audio", IEEE Trans. on Info. Forensics and Security (TIFS), Vol. 14, No. 2, pp. 277-288, Feb. 2019.

J2 S. Han, **Q. Zhu**, J. Li, and Y. Zhou, "Generalized Rough Set-based Information Filling Technique for Failure Analysis of Thruster Experimental Data", Chinese Journal of Aeronautics, Vol. 26, No. 5, pp. 1182-1194, Oct. 2017.

J3 J. Wu, Z. Mou, **Q. Zhu**, J. Li, and Y. Zhou, "Decoupled Target Tracking with Bearing-only Measurements", Optical Engineering, Vol. 51, No. 12, pp. 126401, Dec. 2012.

J4 **Q. Zhu**, X. Tian, C.-W. Wong and M. Wu, "Learning Your Heart Actions: ECG Waveform Reconstruction From PPG", submitted for journal publication.

J5 **Q. Zhu**, M. Chen, C.-W. Wong and M. Wu, "Adaptive Multi-Trace Carving for Robust Frequency Tracking in Forensic Applications", under preparation for journal submission.

J6 **Q. Zhu**, C.-W. Wong and M. Wu, "Robust Fitness Pulse Rate and Pulse Rate Varibility Measurement From Face Videos", under preparation for journal submission.

J7 M. Chen, **Q. Zhu**, M. Wu and Q. Wang, "Amplitude and Frequency Modulation for Vital Signs Extraction From Photoplethysmography Signal", under preparation for journal submission

C1 **Q. Zhu**, X. Tian, C.-W. Wong, and M. Wu, "ECG Reconstruction via PPG: A Pilot Study", IEEE International Conf. on Bio. and Health Informatics, 2019. [43/394=**10% acceptance rate** for oral presentation of regular paper]

C2 M. Chen, **Q. Zhu**, H. Zhang, M. Wu, and Q. Wang, "Respiratory Rate Estimation From Face Videos", IEEE International Conf. on Bio. and Health Informatics, 2019. [123/394=31% acceptance rate for regular paper]

C3 **Q. Zhu**, M. Chen, C.-W. Wong, and M. Wu, "Adaptive Multi-Trace Carving Based on Dynamic Programming", Asilomar Conf. on Signals, Systems, and Computers, 2018.

C4 **Q. Zhu**, C.-W. Wong, C.-H. Fu and M. Wu, "Fitness Heart Rate Measurement Using Face Videos", IEEE International Conf. on Image Proc. (ICIP), 2017.

C5 Y. Wang, S. Zhao, J. Li, J. Kuang, and **Q. Zhu**, "Recurrent Neural Network for Spectral Mapping in Speech Bandwidth Extension", IEEE Global Conf. on Sig. and Info. Proc. (GlobalSIP), 2016.

C6 **Q. Zhu** and J. Li, "Joint Estimation of State and Parameter for Tracking System Using EM–UKF", IASTED International Sympo. on Power and Energy, 2013.

C7 Z. Zhang, J. Li, S. Han, and **Q. Zhu**, "Muti–Target Tracking Using the Sign of Innovations in Wireless Sensor Networks", 2012 Chinese Control and Decision Conf. (CCDC), 2012.

C8 X. Tian, **Q. Zhu**, Y. Li, and M. Wu, "Cross-domain Joint Dictionary Learning fro ECG Reconstruction From PPG", submitted for conference publication.

Patent

P1 **Q. Zhu**, X. Tian, C.-W. Wong, and M. Wu, "Reconstruction of ECG from PPG Signals for Continuous Monitoring and Analytics", provisional patent filing Mar. 2019.

P2 **Q. Zhu**, M. Chen, C.-W. Wong, and M. Wu, "Methods for Tracking Weak Signal Traces Under Severe Noise and Distortions", provisional patent filing Sept. 2018, formal filing Sept. 2019.

P3 N. Gadgil, G. Su, **Q. Zhu**, and Q. Song, "Reducing Banding Artifacts in HDR Imaging via Adaptive SDR-to-HDR Reshaping Functions", provisional patent filing Aug. 2018.

P4 M. Wu, C.-W. Wong, **Q. Zhu**, C.-H. Fu, and J. Su, "Heart Rate Measurement for Fitness Exercises Using Facial Video", provisional patent filing Sept. 2017, formal filing Sept. 2018.

Honors and Awards

Jacob K. Goldhaber Travel Award, University of Maryland, College Park	2018-2019
Teaching Assistant Training Development Fellow Mentor, University of Maryland, College Park	2017-2018
ECE Distinguished Teaching Assistant, University of Maryland, College Park	2015
2nd Prize of Excellent Student Scholarship , Shanghai Jiaotong University, Shanghai, China	2011-2014
1st Prize and 2nd Prize of Excellent Student Scholarship, Zhejiang University, Hangzhou, China	2007-2008