Ke Wang

Curriculum Vitae

Mobile Processor Innovation (MPI) Lab
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Education

2018–2023 **PhD, Electrical Engineering and Computer Sciences**, *University of California*, Berkeley.
Computer vision, Inverse problem, Computational imaging, Signal Processing, Medical Imaging, Magnetic resonance imaging.
Thesis: Magnetic Resonance Image Reconstruction with Greater Fidelity and Efficiency
Advisors: Prof. Michael (Miki) Lustig and Prof. Stella Yu

2014–2018 : **Bachelor of Engineering, Biomedical Engineering**, *Tsinghua University*, *Summa Cum Laude*.
GPA : $91/100$, Ranked $1^{st}/28$ in the department of Biomedical Engineering

Work Experience

May 2023 – present **Senior Research Engineer at Samsung Research America (SRA)**.
Imaging researcher at SRA MPI lab working on real-world computational photography and computer vision problems for next-generation smartphone cameras.

May 2022 – March 2023 **Research Scientist Intern at Adobe Research**.
Proposed a novel semi-supervised training strategy for parametric image harmonization. Our model is fully parametric and learns complex local appearance harmonization from unpaired real composites, where foreground and background come from different images. Our method outperforms previous work on established benchmarks and real composites.
Paper published at CVPR 2023; patent filed.
Advisors : Michaël Gharbi, Eli Schechtman, Zhihao Xia, and He Zhang.

May 2021 – August 2021 **Research Intern at Adobe Emerging Product Group (EPG)**.
Developed low-cost algorithms for real-time high-resolution image matting. Our approach yields high quality matting results on 4k images without additional access to Trimap and background information.
Paper submitted to ICCV 2023; Successfully deployed in PhotoShop Camera v1.5; manuscript available upon request; patent filed.
Advisors : Xin Lu and Zichuan Liu

Publications

Journal Articles and Preprints

2023 **Ke Wang**, Michaël Gharbi, He Zhang, Zhihao Xia, and Eli Shechtman. Semi-supervised parametric real-world image harmonization. *arXiv preprint arXiv:2303.00157 (Accepted to CVPR 2023)*, 2023.

2023 **Ke Wang**, Mariya Doneva, Jakob Meineke, Thomas Amthor, Ekin Karasan, Fei Tan, Jonathan I Tamir, Stella X Yu, and Michael Lustig. High-fidelity direct contrast synthesis from magnetic resonance fingerprinting. *Magnetic Resonance in Medicine*. Wiley Online Library, 2023.

2022 **Ke Wang**, Mariya Doneva, Jakob Meineke, Thomas Amthor, Ekin Karasan, Fei Tan, Jonathan I Tamir, Stella X Yu, and Michael Lustig. High-fidelity direct contrast synthesis from magnetic resonance fingerprinting. *arXiv preprint arXiv:2212.10817*, 2022.

2022 Efrat Shimron, Jonathan I Tamir, **Ke Wang**, and Michael Lustig. Implicit data crimes: Machine learning bias arising from misuse of public data. *Proceedings of the National Academy of Sciences*, volume 119, page e2117203119. National Acad Sciences, 2022.

2021 **Ke Wang**, Michael Kellman, Christopher M Sandino, Kevin Zhang, Shreyas S Vasanawala, Jonathan I Tamir, Stella X Yu, and Michael Lustig. Memory-efficient learning for high-dimensional mri reconstruction. ***Accepted by MICCAI 2021*** *arXiv preprint arXiv:2103.04003*, 2021.

2021 **Ke Wang**, Enhao Gong, Yuxin Zhang, Suchadrima Banerjee, Greg Zaharchuk, and John Pauly. Outcomes: Rapid under-sampling optimization achieves up to 50% improvements in reconstruction accuracy for multi-contrast mri sequences. *arXiv preprint arXiv:2103.04566*, 2021.

2020 Jonathan I Tamir, Frank Ong, Suma Anand, Ekin Karasan, **Ke Wang**, and Michael Lustig. Computational mri with physics-based constraints: Application to multicontrast and quantitative imaging. *IEEE Signal Processing Magazine*, volume 37, pages 94–104. IEEE, 2020.

2020 Oliver Maier, Steven H Baete, Alexander Fyrdahl, Kerstin Hammernik, Seb Harrevelt, Lars Kasper, Agah Karakuzu, Michael Loecher, Franz Patzig, Ye Tian, **Ke Wang**, Daniel Gallichan, Martin Uecker, and Florian Knoll. Cg-sense revisited: Results from the first ismrm reproducibility challenge. *arXiv preprint arXiv:2008.04308 (Accepted to Magnetic Resonance in Medicine)*, 2020.

2018 **Ke Wang**, Han Song, Jiahui Zhang, Xinran Zhang, and Hongen Liao. Reconstruction and registration of large-scale medical scene using point clouds data from different modalities. *arXiv preprint arXiv:1809.01318*, 2018.

In Conference Proceedings

2023 **Ke Wang**, Michaël Gharbi, He Zhang, Zhihao Xia, and Eli Shechtman. Semi-supervised parametric real-world image harmonization. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2023.

2023 Fei Tan, **Ke Wang**, Michael Lustig, and Peder Larson. Iterative motion-compensated reconstruction with convolutional neural network (imoco-net) for ultrashort echo time (ute) proton lung mri. In *Proc. Intl. Soc. Mag. Reson. Med*, 2023.

2023 Alfredo De Goyeneche, Shreya Ramachandran, **Ke Wang**, Ekin Karasan, Joseph Yitan Cheng, Stella X. Yu, and Michael Lustig. Physics-informed deep learning framework for mri off-resonance correction trained with noise instead of data. *Advances in Neural Information Processing Systems*, 2023.

2022 **Ke Wang**, Anastasios Angelopoulos, Alfredo De Goyeneche1, Amit Kohli, Efrat Shimron, Stella Yu, Jitendra Malik, and Michael Lustig. Rigorous uncertainty estimation for mri reconstruction **(Oral)**. In *Proc. Intl. Soc. Mag. Reson. Med*, 2022.

2022 Efrat Shimron, Alfredo De Goyeneche, **Ke Wang**, Ali B. Syed, Shreyas Vasanawala, and Michael Lustig. Bladenet: Rapid propeller acquisition and reconstruction for high spatio-temporal resolution abdominal mri **(Oral)**. In *Proc. Intl. Soc. Mag. Reson. Med*, 2022.

2022 Alfredo De Goyeneche1, Shreya Ramachandran, **Ke Wang**, Ekin Karasan, Stella Yu, and Michael Lustig. Resonet: Physics informed deep learning based off-resonance correction trained on synthetic data **(Oral)**. In *Proc. Intl. Soc. Mag. Reson. Med*, 2022.

2021 **Ke Wang**, Michael Kellman, Christopher Sandino, Kevin Zhang, Shreyas S. Vasanawala, Jonathan I. Tamir, Stella X. Yu, and Michael Lustig. Memory-efficient learning for high-dimensional mr reconstruction **(Magna cum Laude Award)**. In *Proc. Intl. Soc. Mag. Reson. Med*, 2021.

2021 Efrat Shimron, Jonathan I. Tamir, **Ke Wang**, and Michael Lustig. Subtle inverse crimes: Naively using publicly available images could make reconstruction results seem misleadingly better! **(Oral, Magna cum Laude Award)**. In *Proc. Intl. Soc. Mag. Reson. Med*, 2021.

2021 Christopher Sandino, Frank Ong, **Ke Wang**, Michael Lustig, and Shreyas S. Vasanawala. Dslr+: Enhancing deep subspace learning reconstruction for high-dimensional mri **(Oral)**. In *Proc. Intl. Soc. Mag. Reson. Med*, 2021.

2021 Somnath Rakshit, **Ke Wang**, and Jonathan I. Tamir. A gpu-accelerated extended phase graph algorithm for differentiable optimization and learning. In *Proc. Intl. Soc. Mag. Reson. Med*, 2021.

2020 **Ke Wang**, Jonathan I. Tamir, Stella X. Yu, and Michael Lustig. High-fidelity reconstruction with instance-wise discriminative feature matching loss **(Oral, Magna cum Laude Award)**. In *Proc. Intl. Soc. Mag. Reson. Med*, 2020.

2020 **Ke Wang**, Mariya Doneva, Thomas Amthor, Vera C. Keil, Fei Tan, Jonathan I. Tamir, Stella X. Yu, and Michael Lustig. High fidelity direct-contrast synthesis from magnetic resonance fingerprinting in diagnostic imaging **(Oral, Summa cum Laude Award)**. In *Proc. Intl. Soc. Mag. Reson. Med*, 2020.

2019 **Ke Wang**, Frank Ong, Jonathan I. Tamir, and Michael Lustig. Unsupervised learning for improved fidelity multi-contrast mri. In *Proc. Intl. Soc. Mag. Reson. Med*, 2019.

2019 **Ke Wang**, Ekin Karasan, Doneva Mariya, and Michael Lustig. Towards high fidelity direct-contrast synthesis from magnetic resonance fingerprinting. In *NeurIPS 2019 Workshop on Medical Imaging*, 2019.

2019 Hao Nan, Aidan Fitzpatrick, **Ke Wang**, and Amin Arbabian. Non-invasive remote temperature monitoring using microwave-induced thermoacoustic imaging. In *2019 41st Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, pages 6375–6378. IEEE, 2019.

2018 **Ke Wang**, Enhao Gong, Suchandrima Banerjee, and John M. Pauly. Real-time personalized acquisition optimization: 30%-50% reconstruction improvements from a 10-second undersampling optimization. In *Proc. Intl. Soc. Mag. Reson. Med*, 2018.

Research Experience

University of California, Berkeley, USA

August 2022 – present **Complex-valued Scattering Representations**.
Proposing learnable Complex-valued Scattering Representations (CSR) as a universal complex-valued representation for modeling input data's spatial and spatial-frequency properties. By designing learnable scattering filters and new activation functions, our method sets new state-of-the-art (SOTA) results for lean model classification tasks, particularly in small data regimes.
Work submitted to ICCV 2023.
Advisors : Prof. Michael (Miki) Lustig, Prof. Stella Yu

May 2021 – present **Rigorous Uncertainty Estimation for MRI Reconstruction**.
Proposing a pixel-wise uncertainty estimation framework for general MRI reconstructions, which is able to provide probability-guaranteed confidence intervals for any pre-trained reconstruction models. Our proposed framework was demonstrated on FastMRI brain and knee datasets and can be further used to evaluate the reliability of reconstruction algorithms and assist clinical diagnosis.
Work published at ISMRM 2022.
Collaborators: Anastasios Angelopoulos, Amit Kohli
Advisors : Prof. Michael (Miki) Lustig, Prof. Stella Yu, and Prof. Jitendra Malik

May 2020 – May 2022 **Memory-efficient Learning for High-dimensional MR Reconstruction**.
Developed a memory-efficient learning (MEL) framework for high-dimensional MR reconstruction to enable training larger and deeper unrolled networks on a single GPU. We demonstrated improved image quality with learned reconstruction enabled by MEL for 3D MRI and 2D cardiac cine applications.
Work published at ISMRM 2021, MICCAI 2021.
Advisors : Prof. Michael (Miki) Lustig and Prof. Stella Yu

Jul 2019 – May 2022 **High Fidelity Deep Learning-based MRI Reconstruction with Instance-wise Discriminative Feature Matching Loss**.

Developed a novel instance-to-instance discriminative feature loss function (UFLoss) for deep MR image reconstruction, which is able to encourage more realistic reconstructed images with more subtle details and finer textures compared to conventional methods. The proposed loss function can be easily incorporated into any supervised deep learning-based reconstruction framework.

Work published at ISMRM 2020, journal - Magnetic Resonance of Medicine.

Advisors : Prof. Michael (Miki) Lustig and Prof. Stella Yu

Oct 2018 – May 2023 **High Fidelity Direct-Contrast Synthesis from Magnetic Resonance Fingerprinting in Diagnostic Imaging**.

Proposed a GAN-based method to learn the mapping from Magnetic Resonance Fingerprinting data directly to synthesized high-fidelity MR contrast-weighted (T1w, T2w, FLAIR) images. The proposed method is able to generate diagnostic MR images within a single sequence, largely reducing the scan time from over 10 minutes to less than 1 minute. The proposed framework has been evaluated on both volunteer and patient scans.

Work published at ISMRM 2020, Neurips Workshop 2019, journal - Magnetic Resonance of Medicine.

Advisor : Prof. Michael (Miki) Lustig and Prof. Stella Yu

Sep 2018 – Dec 2018 **Unsupervised Learning for Improved Fidelity Multi-contrast MRI**.

Presented an unsupervised learning approach based on convolutional sparse coding for improved fidelity multi-contrast MR reconstruction. The proposed method was able to learn the image prior from a large number of existing datasets and reconstruct multi-contrast images with improved image quality and more faithful contrast.

Work published at ISMRM 2019.

Advisor : Prof. Michael (Miki) Lustig

Stanford University, USA

Jun 2017 – Sep 2017 **Non-Invasive Remote Temperature Monitoring Using Microwave-Induced Thermoacoustic Imaging**.

Developed an accurate real-time temperature mapping system using thermoacoustic imaging. The proposed system was able to generate real-time temperature mapping with less than $\pm 1°C$ error. Conducted validation experiments using linear-scans and circular-scans. (UGVR program project, 18 students selected from China)

Work published at EMBC 2019.

Advisor : Prof. Amin Arbabian

Jun 2017 – Sep 2017 **GPU Accelerated MR Trajectory Optimization**.

Proposed a sampling trajectory optimization algorithm for MR parallel imaging and compressed sensing using genetic algorithm. Accelerated optimization process using GPU and C++/MATLAB coding, reducing the computation time from 60 seconds to 5 seconds, makes the real time trajectory optimization feasible for clinical scans.

Work published at ISMRM 2018.

Advisor : Prof. John M. Pauly

Tsinghua University, China

Jan 2018 – Jun 2018 **Reconstruction and Registration of Large-scale Medical Scene Using Point Clouds Data from Different Modalities**.

Developed reconstruction and registration approaches for 3D point clouds from LiDAR and Kinect, which is able to recover large scale 3D scene from different modalities. The algorithm has been validated in reconstructing a large-scale medical scene from an operation room.

Work published at ACCAS 2018 - won Best Poster Award

Advisor : Prof. Hongen Liao

Apr 2016 – June 2018 **Fast Temperature Estimation for MR Guided Microwave Ablation**.
Proposed a fast temperature estimation algorithm based on Multi-baseline method and Referenceless method using Golden Angle Radial trajectories for MR guided HIFU ablation. Conducted phantom experiments and in-vivo experiments to illustrate the effectiveness of the proposed method.
Work published at ISMRM 2017,2018.
Advisor : Prof. Kui Ying

Fellowships & Awards

2021 **ISMRM Magna cum Laude Award**
2020 **ISMRM Summa cum Laude Award**
2020 **ISMRM Magna cum Laude Award**
2019-present **ISMRM Educational Fellowship**
2018 **Best Poster Award for ACCAS 2018**
2018 **Berkeley EECS Department Fellowship**
2018 **Tsinghua Excellent Graduate Honor**
2018 **Beijing Excellent Graduate Honor**
2015, 2017 **National Scholarship**

Computer skills

Deep Learning: Proficient with PyTorch, TensorFlow. Familiar with MXNet.
Programming Languages: Proficient with Python, MATLAB, C/C++, Shell script, LaTeX
Additional Skills: Deep Learning, Computational Imaging, Computer Vision, Inverse problem, Signal processing, Spectrum analysis, MRI reconstruction, GE sequence programming, and reconstruction platform

Service

2023 **Reviewer for ISMRM, Siggraph, Siggraph Asia, MICCAI, Neurips**.
2022 **Reviewer for MICCAI, EMBC, ISMRM**.
2023-present **Reviewer for Scientific Report**.
2023-present **Reviewer for Quantitative Imaging in Medicine and Surgery**.
2022-present **Reviewer for Magnetic Resonance in Medicine**.
2022-present **Reviewer for IEE Transaction on Medical Imaging**.
2022-present **Reviewer for Frontiers in Oncology**.
2022-present **Reviewer for Computational and Mathematical Methods in Medicine**.
2020-present **Reviewer for IEEE Transactions on Circuits and Systems for Video Technology**.

References

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Dr. Stella Yu
Professor
Computer Science and Engineering
University of Michigan
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