Salah Assana

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Education

Massachusetts Institute of Technology (4.9 / 5.0) *Cambridge, Massachusetts*
Master of Science *Sep 2018 - May 2020*
- **Thesis:** Contactless Cardiovascular Activity Monitoring Using mmWaves

University of Virginia (3.87 / 4.0) *Charlottesvile, Virginia*
Bachelor in Computer Science *Sep 2015 - May 2017*
- **Thesis:** Privacy-preserving Image Processing with Binocular Thermal Cameras

Northern Virginia Community College (3.84 / 4.0) *Sterling, Virginia*
Associate in Computer Science *Sep 2013 - May 2015*

Research Experience

Harvard Medical School - Translational Cardiovascular Imaging Lab *Boston, MA*
Advisor: Reza Nezafat *Jan. 2021 - Present*
- **Quantitative Ultrashort Echo Time of Pulmonary Edema:** *Pulmonary edema is a cardinal feature of heart failure but no quantitative tests are available in clinical practice. The goal of this project was to study the capability of using an ultrashort echo time (UTE) sequence to quantitatively measure the severity of pulmonary edema at rest and post exercise.*
  - Designed imaging protocol to assess potential for pulmonary edema quantification during rest and after exercise.
  - Independently operated scanner and collected lung UTE data from healthy volunteers and heart failure patients.
  - Quantified lung water volume using in-house software to segmented lung parenchyma and compute lung water density.
  - Statistically evaluated repeatability and reproducibility of lung UTE-derived water volume measured.
- **Accelerated Cine MR Imaging of Cardiac Function During Exercise:** *Exercise CMR is a promising stress imaging test for coronary artery disease, but requires accelerated imaging techniques that result in significant aliasing artifacts. Acceleration methods like compressed sensing alleviate aliasing issues but require long reconstruction times preventing clinical adoption. My goal is to develop and evaluate a DL-based radial acceleration technique for exercise CMR.*
  - Developed 3D U-Net based reconstruction technique for real-time radial cine with an acceleration rate of 12 for Ex-CMR.
  - Simulated undersampled radial images by inputting Cartesian k-space data into an inverse NUFFT with 12 radial lines.
  - Deployed the trained model on the hospital scanner for in-vivo evaluation on patients with suspected CAD.
  - Evaluate generalizability by reconstructing undersampled perfusion images despite never training on perfusion images.
- **Accelerated Cardiac T1 Mapping in Four Heartbeats:** *Cardiac T1 mapping is an imaging approach used to characterize myocardial tissue (e.g., fibrosis, edema). However, current techniques require a long 17-heartbeat breath-holding time which can be difficult for some patients. We sought to utilize neural networks to enable T1 mapping using just 4 heartbeats.*
  - Investigated best hyperparameters for training a FCNN to estimate T1 values using just 4 heartbeats.
  - Evaluated impact on performance with different deep learning architectures such as CNN and U-Net.
  - Assessed the clinical utility by conducting a multi-vendor and multi-center study to evaluate performance.
  - Collaborated with Siemens engineers to deploy ML models on the scanner for integration into the clinical workflow.

Massachusetts Institute of Technology - Media Lab *Cambridge, MA*
Co-Advisors: Fadel Adib & Rosalind Picard *Sep 2018 - Aug, 2020*
- **Contactless Cardiovascular Activity Monitoring Using mmWaves**
  - Developed a novel mmWave sensor capable of contactless cardiovascular activity monitoring.
  - Used C++ Boost library to enable the use of multiple sensors concurrently and allow for real-time data evaluation.
  - Used MATLAB to filter signal and analyze the cardiac data for signs of atrial fibrillation and ischemia.

University of Virginia - Link Lab *Charlottesville, VA*
Co-Advisors: Kamin Whitehouse & David Evans *Sep 2015 - May 2017*
- **Privacy-preserving Image Processing with Binocular Thermal Cameras**
  - Introduced a new doorway sensor capable of determine travel direction with 99.7% accuracy.
  - Wrote multi-threaded C driver to increase speed of sensor by 3000% and reduced energy consumption by 50%.
  - Develop an ultra-optimized optical flow tracking algorithm robust to illumination changes & background movement.

Publications

S Assana, et al. "Quantification of Lung Water Parameters Using Ultra-Short Echo Magnetic Resonance Imaging at 3 Tesla." *Journal of Magnetic Resonance Imaging (**JMRI**)* - In Revision

M Morales, **S Assana**, et al. "Deformation-Encoding Deep Learning Transformer (DENT) for High Frame Rate Cine Cardiac MRI." ***Radiology***

S Yoon, **S Assana**, et al. "Accelerated Cardiac MR Cine Imaging using Resolution Enhancement Generative Adversarial Inline Neural Network." ***Radiology*** 307.5 (2023): e222878.

M Morales, **S Assana**, et al. "An inline deep learning based free-breathing ECG-free cine for exercise cardiovascular magnetic resonance." *Journal of Cardiovascular Magnetic Resonance (**JCMR**)* 24.1 (2022): 1-14.

R Guo, Z Chen, A Amyar, H El-Rewaidy, **S Assana**, et al. "Improving accuracy of myocardial T1 estimation in MyoMapNet." *Magnetic Resonance in Medicine (**MRM**)* (2022).

A Amyar, R Guo, X Cai, **S Assana**, et al. "Impact of deep learning architectures on accelerated cardiac T1 mapping using MyoMapNet." ***NMR in Biomedicine*** 35.11 (2022): e4794.

R Guo, H El-Rewaidy, **S Assana**, et al. "Accelerated cardiac T1 mapping in four heartbeats with inline MyoMapNet: a deep learning-based T1 estimation approach." *Journal of Cardiovascular Magnetic Resonance (**JCMR**)* 24.1 (2022): 1-15.

A Fahmy, I Csecs, A Arafati, **S Assana**, et al. "An Explainable Machine Learning Approach Reveals Prognostic Significance of Right Ventricular Dysfunction in Nonischemic Cardiomyopathy." *Cardiovascular Imaging (**JACC**)* 15.5 (2022): 766-779.

U Ha, **S Assana**, and Fadel Adib. "Contactless seismocardiography via deep learning radars." *Proceedings of the 26th Annual International Conference on Mobile Computing and Networking (**MobiCom**)*. (pp. 1-14) 2020.

E Griffiths, **S Assana**, and Kamin Whitehouse. "Privacy-preserving image processing with binocular thermal cameras." *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (**UbiComp**)* 1.4 (2018): 1-25.

Conferences

S Assana, et al. *An Open-source, Flexible, Plug-and-play Inline CMR Image Segmentation Platform.* at the International Society for Magnetic Resonance in Medicine (**ISMRM**). 2024.

S Assana, et al. *Breath-Hold UTE Stack-of-Spirals Lung Water Volume Quantification at Rest and Physiological Exercise at 3T.* at the Society for Cardiovascular Magnetic Resonance (**SCMR**). 2023.

F Ghanbari, **S Assana**, et al. *Artificial Intelligence-enabled Exercise-CMR for Evaluation of Cardiac Functional Reserve in Heart Failure* at the Society for Cardiovascular Magnetic Resonance (**AHA**). 2023.

S Yoon, **S Assana**, et al. *Cardiac MR Denoising Inline Neural Network (CaDIN)* at the International Society for Magnetic Resonance in Medicine (**ISMRM**). 2023.

S Assana, et al. *Radial Perfusion Cardiac Magnetic Resonance Imaging Using Deep Learning Image Reconstruction.* at the International Society for Magnetic Resonance in Medicine (**ISMRM**). 2022.

S Assana, et al. *A Guide To Deploying Deep Learning Models On Scanner: A Case Study With MyoMapNet.* at the Society for Cardiovascular Magnetic Resonance (**SCMR**). 2022.

Industry Experience

Booz Allen Hamilton *Tysons, VA*

Machine Learning Engineer *Sep. 2017 - Aug. 2018*

- Worked as full stack developer on a scrum team with C# and JavaScript libraries like AngularJS & Backbone.
- Used Hadoop and Hive to build a scalable distributed data lake on AWS.
- Built a abstractive text summarization tool using TensorFlow, NumPy, Pandas and Pyrouge.

Awards & Honors

2017 **Louis T. Rader Undergraduate Research Award**, University of Virginia

2017 **Phi Beta Kappa**, University of Virginia