

# Kinjal Shah

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## Education

### Johns Hopkins University, MSE in Robotics

Baltimore, MD

Laboratory for Computational Sensing and Robotics, Whiting School of Engineering | GPA: 3.87

May 2021

- Masters Thesis: Enabling Cognitive Load Aware User Interfaces for Mixed Reality
- Research Interests: Wearables, AR/VR, Accessibility, Human-AI Interfaces, Haptics, AI for Social Good
- Relevant coursework: Human Computer Interaction, Augmented Reality, Haptic Interface Design, Machine Learning, Deep Learning, Computer Integrated Surgery, Algorithms for Sensor Based Robotics, Robot Kinematics and Dynamics

### University of Pennsylvania, BSE in Bioengineering

Philadelphia, PA

School of Engineering and Applied Science | *Magna Cum Laude* | GPA: 3.67

Aug 2016

- Relevant coursework: Brain Computer Interfaces, Bioengineering Modeling and Design, Biomicrofluidics

### The Wharton School, BS in Economics

Philadelphia, PA

Concentration in Operations Management | *Magna Cum Laude* | GPA: 3.67

Aug 2016

- Relevant coursework: Product Design, Decision Processes, Healthcare Policy, Venture Capital

## Research Experience

### Enabling Cognitive Load Aware User Interfaces for Mixed Reality

Baltimore, MD

Thesis Advisor: Professor Mathias Unberath

July 2020-Present

*Accepted to Women in Machine Learning (WiML) Workshop 2020 - Poster Presentation*

- Developed predictive models for detection of cognitive state changes from pupillometry data in unconstrained environments
- Built real-time signal processing pipeline for multi-sensor time series data while maintaining temporal alignment
- Designed experimental protocols for user study to capture eye tracking data under varying environmental conditions and cognitive demand levels

### Automated Point-of-Care Pancreatic Cancer Diagnostic

Philadelphia, PA

Research Advisor: Professor David Issadore

Aug 2015-May 2016

*Bioengineering Senior Design Award, First Honorable Mention – SEAS Senior Design Competition*

- Developed on-chip diagnostic protocol to detect pancreatic cancer cell derived exosomes at precancerous concentrations
- Created control system with Arduino, image processing platform with MATLAB, and 3D printed encasing with SolidWorks

## Engineering Projects

### Early fall detection from video using 3D-CNNs

Baltimore, MD

*Winner of Intuitive Surgical Best Project Award*

Nov 2020-Jan 2021

- Developed procedure based on natural language descriptions to isolate videos of falls from over 20,000 videos
- Applied 3D-human-pose estimation algorithm in conjunction with optical flow analysis to determine fall speed
- Adapted 3D-ResNet action recognition model architecture to perform frame wise classification of falls in video

### Intraoperative Guidance of Orthopaedic Instruments

Baltimore, MD

*Accepted to SPIE Medical Imaging 2021*

Jan 2020-June 2020

- Implemented and evaluated performance of U-Net and Mask R-CNN architectures for surgical guidewire detection
- Designed simulated dataset generation pipeline enabling generalization to clinical images with 87% recall and 90% precision

### Haptic Feedback for Upper Limb Motion Guidance

Baltimore, MD

*Accepted to 2020 Haptics Symposium Work-in-Progress Track*

Sep 2019-Jan 2020

- Developed wearable device prototype to enable motion guidance for rehabilitation through cutaneous haptic feedback
- Designed haptic feedback algorithm to stimulate vibration motors via a Raspberry Pi in response to IMU sensor data

## Skills

- Programming and Embedded Systems: Python, C++, C#, MATLAB, Arduino, Raspberry PI, Git
- Mixed Reality: Unity, Microsoft HoloLens, Pupil Core, Human-AI Interfaces, Human Subjects Research, Haptic Interfaces
- Machine Learning Libraries: PyTorch, TensorFlow, OpenCV

## Work Experience

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### Johns Hopkins University

Research Assistant: ARCADE Lab

Baltimore, MD  
May 2021-Present

- Enabling workload aware intelligent agents for AR/VR applications using human-centered design process
- Progressing thesis work towards larger scale user study

Course Assistant: Machine Learning - Deep Learning

Jan 2021-May 2021

Teaching Assistant: Haptic Interface Design for Human-Robot Interaction

Aug 2020-Dec 2020

- Conducted office hours, graded assignments, and mentored students in completion of final projects

### Accenture

Philadelphia, PA

Life Sciences Consultant (2018-19), Senior Analyst (2017-18), Analyst (2016-17)

Nov 2016-Apr 2019

- Designed R&D technology strategy road-map for transformation initiative at a global biotechnology company
- Managed clinical cloud implementation from strategy definition through launch involving future state design, requirements gathering, user acceptance testing, and change management
- Assessed merger and acquisition options for client facing loss of patent protection on key revenue generator

## Poster Presentations

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*Causal model for cognitive load estimation in mixed-reality environments*

**Kinjal Shah**, Wenhao Gu, Mathias Unberath

Women in Machine Learning (WiML) 2020 - Poster

## Publications

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*Intraoperative Guidance of Orthopaedic Instruments Using 3D Correspondence of 2D Object Instance Segmentations*

Irina Bataeva, **Kinjal Shah**, Rohan Vijayan, Runze Han, Niral Sheth, Gerhard Kleinszig, Sebastian Vogt, Greg Osgood, Jeffrey H. Siewerdsen, Ali Uneri  
SPIE Medical Imaging 2021

*Feasibility of Image-based Augmented Reality Guidance of Total Shoulder Arthroplasty Using Microsoft HoloLens 1*

Wenhao Gu, **Kinjal Shah**, Jonathan Knopf, Nassir Navab, Mathias Unberath

**Outstanding Paper Award**

MICCAI 2020 Joint Workshop on Augmented Environments for Computer-Assisted Interventions

Journal of Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization

*A County-level Dataset for Informing the United States' Response to COVID-19*

Benjamin D. Killeen, Jie Ying Wu, **Kinjal Shah**, Anna Zapaishchykova, Philipp Nikutta, Aniruddha Tamhane, Shreya Chakraborty, Jinchi Wei, Tiger Gao, Mareike Thies, Mathias Unberath  
<https://arxiv.org/pdf/2004.00756.pdf>

*Proposing a framework for evaluating haptic feedback as a modality for velocity guidance*

**Kinjal Shah\***, Shweta Ravichandar\*, Jeremy D. Brown

Haptics Symposium 2020: Work-in-Progress Track

## Open Source Initiatives

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### COVID-19 United States County-level Dataset

[https://github.com/JieYingWu/COVID-19\\_US\\_County-level\\_Summaries](https://github.com/JieYingWu/COVID-19_US_County-level_Summaries)

Winner of Kaggle COVID-19 Dataset Award

## Honors and Awards

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Intuitive Surgical Best Project Award

2020

AE-CAI Outstanding Paper Award

2020

Computer-Integrated Surgical Systems and Technology Project Award

2020

LCSR Faculty Scholarship

2019-2021

Ruhr Fellowship

2014

Advancing Women in Engineering Research Scholar

2013