Bharat Chandrahas Dandu

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EDUCATION

Ph.D. Electrical and Computer Engineering, University of California, Santa Barbara, USA - Defense expected in Nov 2021.

- *Research Topics:* **Haptic Engineering**, Perception, HCI, VR

M.S. Electrical and Computer Engineering, University of California, Santa Barbara, USA - 2016. (CGPA 4/4)

- *Major:* Communications, Controls and **Signal Processing**

B.Tech Electrical Engineering, Indian Institute of Technology, Madras, India - 2015. (CGPA 9.04/10)

AWARDS

Best Paper Award : 2020 IEEE Transactions on Haptics, presented at IEEE World Haptics Conference 2021.

Best Technical Demonstration Award at the IEEE World Haptics Conference 2019.

Best Paper Award Finalist at the IEEE World Haptics Conference 2019.

Best Paper Award Nomination at the IEEE Haptics Symposium 2018 conference.

Awarded the UC Santa Barbara ECE Dept. **Ph.D. Dissertation Fellowship**.

Awarded the **MITACS-Globalink 2014 Scholarship** to pursue a research internship in Canada.

PUBLICATIONS

G. Reardon, **B. Dandu**, Y. Shao, Y. Visell, "Shear Shock Waves Constrain Haptic Holography via Focused Ultrasound" **Proceedings of National Academy of Sciences**, Submitted.

N. Kastor, **B. Dandu**, V. Bassari, Y. Visell, "Fluidic Electromagnetic Actuator for Efficient, Dual-Mode Haptic Feedback", In Preparation.

S. Biswas, **B. Dandu**, Y. Shao, Y. Visell, "Stretchable Optoelectronic Skin for Haptic Feedback via Light Fields", In Preparation.

B. Dandu, Y. Shao, Y. Visell, "Rendering Spatiotemporal Haptic Effects via the Physics of Waves in the Skin" **IEEE Transactions on Haptics, 2021**.

B. Dandu, Y. Shao, A. Stanley, Y. Visell, "Spatiotemporal Haptic Effects from a Single Actuator via Spectral Control of Cutaneous Wave Propagation" **Proc. IEEE World Haptics Conference, 2019**.

G. Reardon, Y. Shao, **B. Dandu**, W. Frier, B. Long, O. Georgiou, Y. Visell, "Cutaneous Wave Propagation Shapes Tactile Motion: Evidence from Air-Coupled Ultrasound", **Proc. IEEE World Haptics Conference, 2019**.

B. Dandu, I. Kuling, Y. Visell, "Proprioceptive Estimates of Finger Location Are Coarse, Biased, and Context-Sensitive" **IEEE Transactions on Haptics, 2020**.

B. Dandu, I. Kuling, Y. Visell, "Where Are My Fingers? Assessing Multi-Digit Proprioceptive Localization." **Proc. IEEE Haptics Symposium, 2018**.

Sudha, N., and **D. Bharat Chandrahas**. "A pipelined memory-efficient architecture for face detection and tracking on a multicore environment." **VLSI Design and Test (VDAT), 2015 19th International Symposium on**. IEEE, 2015.

PATENTS

Keller, S.J., Trutna, T.T., Benko, H., King, R., Stanley, A.A., Di Luca, M., Shao, Y., **Dandu, B.**, Visell, Y., Methods, devices, and systems for creating localized haptic stimulations on a user. U.S. Patent Application 16/241,900, filed July 11, 2019.

Keller, S.J., Trutna, T.T., Benko, H., King, R. and Lou, Y., Shao, Y., **Dandu, B.**, Visell, Y., Methods, devices, and systems for creating haptic stimulations and tracking motion of a user. U.S. Patent Application 16/241,871, filed July 11, 2019

RESEARCH EXPERIENCE

RE TOUCH Lab; UC Santa Barbara — June 2018 - Present
Obtaining tactile motion effects with minimal actuators — Supervisor: Yon Visell

- Ran experiments to image mechanical waves on the surface of the hand when excited with various vibro-tactile stimuli.
- Designed custom stimuli to induce a motion percept phenomena in the finger on contacting a single actuator.
- Designed several virtual reality (VR) experiences highlighting the utility of the motion effect.
- Developing rendering algorithms for large-area vibro-tactile effects by utilizing a compact set of actuators on skin.

RE TOUCH Lab; UC Santa Barbara — Dec 2018 - Present
Design of high-bandwidth electromagnetic haptic actuator — Supervisor: Yon Visell

- Developed the design of a novel high fidelity, large bandwidth haptic actuator.
- Optimized the electromagnetic performance of the actuator through finite-element simulations.
- Characterizing the mechanical and electrical performance of the actuator.

RE TOUCH Lab; UC Santa Barbara — Jan 2020 - Present
Design of stretchable opto-electrotactile transducer — Supervisor: Yon Visell

- Performed the electrical design and characterization of a distributed soft conformable actuator which converts light to tactile sensations.
- Designing perceptual experiments to highlight the performance of the actuator.

RE TOUCH Lab; UC Santa Barbara — Feb 2020 - Present
Studying the effect of biomechanical coupling on response diversity of tactile sensory afferents — Supervisor: Yon Visell

- Identified the frequency dependent characteristic of the population response of tactile receptors in response to varied stimuli.
- Assisted in the design of computational simulations aimed at better understanding this phenomena.

RE TOUCH Lab; UC Santa Barbara — June 2018 - Feb 2021
Generation of tactile waves with ultrasound excitation — Supervisor: Yon Visell

- Imaged the deformations of skin on exposure to focused air-coupled ultrasound stimulation.
- Assisted in design of an experiment that highlighted the effect of tactile mechanical waves on perceptual performance.
- Assisted in the design of experiments aimed to identify the fundamental limitations imposed by the existence of tactile waves, on the performance of haptic rendering with ultrasound methods

RE TOUCH Lab; UC Santa Barbara — Sep 2016 - June 2018
Assessing multi-finger proprioceptive localization — Supervisor: Yon Visell

- Conducted multiple psychophysical experiments using virtual reality and finger tracking methods to study the accuracy and precision of the position sense of the human hands and fingers.
- Investigated into how the integration of visual information with proprioceptive cues enhances localization performance.

Dynamics and Control Lab; IIT Madras, IND — Oct 2014 - April 2015
Video processing on multi-core microcontrollers — Supervisor: K. Sridharan

- Developed highly pipelined memory efficient algorithms for use in multi-core microcontrollers.
- Implemented these algorithms to enable real-time video processing in embedded platforms with limited hardware resources.

Optoelectronics and Green Photonics Lab; UAlberta, CAN — May 2014 - July 2014
PbS nanocrystal based photodetectors — Supervisor: Xihua Wang

- Fabricated PbS nanoparticle based photodetectors and performed electrical characterization. Varied the fabrication process parameters with the aim of improving responsivity of the detector.
- Researched into how these devices can be implemented in current imaging technologies by comparing their performance, cost and ease of process integration with conventional image sensors.
- Researched into niche applications of such photodetectors like IR light detectors and flexible sensors, where they are advantageous in terms of cost and ease of fabrication.

Microelectronics and MEMS Lab; IIT Madras, IND — Nov 2013 - Dec 2013
Memory technologies of the future — Supervisor: Nandita Das Gupta

- Identified various Universal Memory technologies under consideration, such as Phase Change Memory and Magnetoresistive RAM.
- Performed a comparative study, identifying advantages and possible avenues of research for each type.

INDUSTRY EXPERIENCE

Facebook Reality Labs, Redmond, WA — July 2019 - Sept 2019
Research Intern — Supervisor:- Cesare Parise

- Performed proprietary research on audio displays and audio-tactile integration.
- Designed and ran multiple psychophysical experiments to evaluate our hypotheses.
- Informed the design of novel audio technologies for augmented reality headsets.

National Thermal Power Corporation, Vizag, IND — June 2013 - July 2013
Intern — Supervisor:- B.S.R. Anjaneyulu

TECHNICAL SKILLS

Programming Languages: MATLAB, Python, C# (.NET), C, C++, Verilog, Java.

Scientific / Engineering Applications: COMSOL, LTSpice, PsychToolbox, SPSS, MAX/MSP, OpenCV, Chai3D, Scikit-learn, Caffe, Tensorflow, Xilinx ISE, Wireshark, OSLO.

Design and Web: Unity, Illustrator, Photoshop, Premiere, MS Office, 3DS Max, HTML, CSS.

Manufacture: Solidworks, AutoCAD, 3D printing.

Hardware platforms: Virtual and augmented reality HMDs, NI DAQs, audio DACs (MOTU) and amplifiers, haptic actuators (Piezo, voice coils, LRA, ERM), Ultrahaptics, servo motors, Polhemus position trackers, Optitrack, Leap Motion, Arduino, Raspberry Pi, Analog Devices Blackfin, Xbee.

Others: Git, LaTeX, Linux shell scripting.

ACADEMIC WORK

Graduate Student Researcher at UC, Santa Barbara — July 2017 - Present

Teaching Assistant at UC, Santa Barbara — Jan 2016 - Present

Research Assistant at University of Alberta, Edmonton — May 2014 - Aug 2014

Journal Paper Reviewer - IEEE Transactions on Haptics

Conference Paper Reviewer - IEEE Haptics Symposium, IEEE World Haptics Conference

PROFESSIONAL AFFILIATIONS

IEEE Student Member — 2014 - Present