

SIDDHARTH KHULLAR

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OVERVIEW

Applied Data & Algorithms Scientist (Wearables and Health-care) – Oriented towards applied research and algorithmic innovation for high impact applications in the areas of consumer and medical wearable devices, non-invasive physiological monitoring, and health data analytics.

Specialist in – Non-invasive physiological signal analysis, wearable medical devices, clinical test protocol and design of experiments (FDA), time-series analysis, machine learning, computer vision, signal quality metrics, anomaly detection, rapid prototyping, working in highly functional and fast-paced teams, start-up delivery processes and agile thinking.

Interested in – Firmware design, consumer hardware development processes, medical device regulation strategies, optical computing and medical sensing on mobile devices, financial time-series analysis, and cognitive systems.

EXPERIENCE

Quanttus, Inc., Cambridge, MA, USA

Principal/Lead Data Scientist, Algorithm Development (2014 – present)

- **Algorithms for Wearables** - Responsible for core development and integration of signal processing algorithms to monitor multiple vital-signs (activity tracking, heart rate, pulse transit time, and heart health) on a wrist-worn device.
- **Insights Engine** - Developed analysis techniques for deriving user-specific insights from vital signs combined with contextual information (location, medical history, activity)
- **HW Integration** - Closely worked across the product teams (FW, SW, UX, T&V and ME) to integrate the algorithms and provide support for optimization of sensor design, power and memory use on the device.

Clinical Studies - Responsible for preparing use-case strategy for FDA-standard clinical studies, derive performance metrics and strategize for 510k filing of wearable health sensors.

Microsoft Research, Redmond, WA, USA

Post-doc Researcher, Computational User Experiences (2013-2014)

Research Intern, Computational User Experiences (2012)

- **Health sensing/imaging** - Leveraged expertise in computer vision to develop new sensing systems and algorithms for tracking health and wellness (physiological sensing, activity monitoring etc.). In particular, responsible for identifying and developing new camera-powered health sensing applications.
- **Camera-based heart-rate** - Developed a robust non-invasive heart-rate system using web-cameras. Supported development for integration of **heart-rate monitor in the XBOX One Kinect camera**.

MIT Media Lab, Massachusetts Institute of Technology, Cambridge, MA, USA

Visiting Researcher, Camera Culture Group (2011-2012)

- **Retinal Imaging** - Led a team to build a low-cost standalone wearable system for imaging the human retina for early detection of diabetic retinopathy and hypertension. Responsible for systematic integration of optics and algorithms that led to addressing major challenges associated with optics of the eye and adjusting system parameters for minimal errors.
- **Mobile Health Care** - Repurposing available mobile devices and conventional cameras for medical imaging. Involved in developing novel prototypical systems that enabled low-cost medical screening using mobile phones. Conditions scanned: Visual Acuity, Cataract, Age-related macular degeneration, Strabismus.

Mind Research Network for Neurodiagnostic Discovery, Albuquerque, NM, USA

Graduate Research Associate, Medical Image Analysis (2009-2013)

- **PhD. Thesis** - "*A Better Looking Brain: Novel Image Preprocessing approaches for fMRI data*". Developed an end-to-end fMRI image processing pipeline that enabled researchers and clinicians to identify neuro-functional abnormalities in patients with conditions such as schizophrenia, autism and bipolar disorder.
- Extensive experience in design, development and implementation of computer vision and unsupervised image manipulation algorithms applied to large data sets such as fMRI and EEG.
- Developed image processing algorithms for fMRI/EEG data and packaged them in MATLAB toolbox(s). **Denoising toolbox** - [WaveDioT](#).

IT Collaboratory, Rochester Institute of Technology, Rochester, NY, USA

Research Assistant, Digital Imaging and Printing (2007-2009)

- **Master's Thesis** - "*Automated tool for unsupervised objective measurement of mottle in laser prints.*" (In collaboration with Color Imaging Division at Hewlett Packard Co., Boise, ID). Developed GUIs with print quality assessment algorithms (new and old) for validation and dissemination across HP for testing. Involved in writing multiple renewal grant proposal & reports.
- **Other Work**: Developed region-based and edge-based color image segmentation and rendering algorithms.

EDUCATION

August 2009 – April 2013:	PhD, Imaging Science Chester F. Carlson Center for Imaging Science Rochester Institute of Technology, NY
August 2007 – May 2009:	M.S. in Electrical Engineering Rochester Institute of Technology, NY
August 2003 – June 2007:	Bachelor of Technology, Electrical Engineering G.G.S. Indraprastha University, New Delhi, India

SELECTED PUBLICATIONS & PATENTS

A full list of publications is available at www.siddharthkhullar.net/research/

"Methods and Apparatus for Retinal imaging", US Patent App. US-20130208241, Feb. 2013.

"Determining pulse transit time non-invasively using handheld devices", US Patent App US-13/783395, Sept 2014.

"Video-based Pulse Measurement", under review by USPTO, filed April 2014.

O. Beijbom, N. Joshi, **S. Khullar**, et al., "Menu-match: Restaurant Specific Food-Logging from Images", Applications of Computer Vision (WACV) 2015.

M.E. Lawson, **S. Khullar**, et al., "Computational Retinal Imaging via Binocular Coupling and Indirect Illumination", ACM SIGGRAPH 2012 (Talk and Poster).

S. Khullar, A.M. Michael, N. Correa, T. Adali, S. Baum, V.D. Calhoun, "Wavelet-based fMRI analysis: 3-D denoising, signal separation and validation metrics", *Neuroimage*, vol. 54, no. 4, Oct. 2010. **(Acceptance Rate: 15 %)**

S. Khullar, A.M. Michael, N.D. Cahill, S.A. Baum, V.D. Calhoun, "Functional Normalization through ICA (ICA-fNORM) with Intrinsic Networks as Functional Templates", 17th Annual meeting of Organization for Human Brain Mapping (HBM), Quebec, Canada, June 2011. (Poster)

S. Khullar, E. Saber, S.A. Dianat, J. Trask, R. Lawton, "Automatic Multi-resolution Spatio-Frequency Analysis for Evaluation of Print Mottle", *SPIE Proc. of 17th Color Imaging Conference, Albuquerque, NM, pp. 100 – 105, Nov. 2009. (Best Student Paper Award Nominee)*

HONORS, AWARDS & GRANTS

- **Science Graduate Delegate and Commencement Speaker** - RIT Commencement 2013.
 - **Featured Speaker** and listed amongst **20 Indian Innovators** – EmTech India 2012.
 - **CIMIT Innovation Prize** for Primary Health Care 2012: 1st Prize – awarded \$160,000 for extended research.
 - **MIT IDEAS Global Challenge** – Dow Chemical’s “Innovative Technology” Prize 2012: \$7500.
 - **IEEE Change the World Challenge 2012: Finalist** – *Retinal Imaging* (Top 15 Global Entries)
 - **Neuroimaging Training Program (NITP) Fellow 2011- UCLA** (Acceptance Rate: 10%).
 - **Imaging Science Micro-Grant (RIT)** – *Eye-tracking for Vertigo* (\$5000); 2011.
 - **Merit Scholarship Recipient** (2009-2012) - Chester F. Carlson Center for Imaging Science, RIT.
 - **MRN Fellowship** for pursuing research in Functional Brain Imaging (2009 – 2012).
 - **Jones Memorial International Students’ Scholarship recipient**, March 2009.
 - **Hewlett Packard R&D Fellowship for Color Imaging Research, RIT.** 2008 – 2009.
 - **Graduate Scholarship**, Department of Electrical Engineering, RIT, 2007-2008.
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SKILLS

- **Programming/Scripting Languages:** MATLAB, Python (NumPy, SciPy), C/C++
 - **Statistical tools and data science:** R, Tableau, RapidMiner
 - **Program Management tools:** JIRA
 - **Design:** Adobe Creative Suite, MS Office, Visio
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References available upon request