

SOUPTIK BARUA

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RESEARCH OVERVIEW

I am a Postdoctoral Research Scientist (Aug 2019-present) in Dr. Ashutosh Sabharwal's Scalable Health Lab at Rice University. My research goal is to contribute to the emerging field of digital health using data science models that are clinically meaningful, scalable, and inclusive. Specifically, my research identifies new data-driven biomarkers and generates novel clinical hypotheses from physiological time-series signals and images. To do this, I design data science solutions using ideas from machine learning, signal processing, computer vision, and statistical analysis, and guided by input from clinical experts. I envision my work will help achieve improved and equitable clinical outcomes and enhance our understanding of various chronic illnesses.

Research highlights:

- **Data science for Diabetes:** I identified temporal biomarkers of diabetes from continuous glucose monitoring using time-series analysis to predict diabetes onset and progression. These biomarkers can help physicians understand the underlying pathways of diabetes progression and design more effective interventions.
- **Data science for Cancer:** I identified image-based biomarkers to predict adverse clinical outcomes in multiple cancer types using spatial statistics and functional data analysis. These biomarkers can help clinicians personalize treatments and provide researchers with new insights into the biological mechanisms of cancer.

EDUCATION

Rice University, Houston, TX Ph.D. in Electrical and Computer Engineering Specialization: Data Science and Machine Learning	2019
Rice University, Houston, TX Master of Science in Electrical Engineering Specialization: Signals and systems	2015
Indian Institute of Technology, Kharagpur, India Bachelor and Master of Technology (dual degree) in Electrical Engineering Specialization: Signal Processing	2012

GRANTS AND AWARDS

- **PATHS-UP seed grant:** Winner of the 2019 and 2021 Precise Advanced Technologies and Health Systems for Underserved Populations (PATHS-UP) Innovation seed grant to research the use of wearable sensors for diabetes management in an underserved Hispanic/Latino community suffering a disproportionate burden of type 2 diabetes. PATHS-UP is an NSF-funded engineering research center focused on affordable technological solutions for chronic diseases in underserved populations.
- **Global Ph.D. summit fellow:** Selected as one of 13 fellows of the inaugural global PhD summit hosted by EPFL, Lausanne, Switzerland in November, 2018. The theme of the conference was "Data-driven Research in the Life Sciences".

- **Future faculty fellow:** Selected as one of 6 fellows for Rice’s 2021 Future Faculty Fellows program. The program provides fellows with expert coaching and training for the faculty application process including preparing research and teaching statements, preparing for interviews and job talks, and starting a research lab.

TEACHING AND MENTORSHIP EXPERIENCE

- **DSCI 303 - Machine Learning for Data Science:** Instructor of record for the course titled ”Machine learning for data science”. 3-credit hour UG class taken by 14 students. Designed course lectures and exams, supervised final projects, and organized two guest lectures on real-world data science applications in physiological imaging and online content monitoring.
- **Program Lead, PATHS-UP REU Program:** Program lead for the PATHS-UP research experience for undergraduates program at Rice University since 2019. Mentored 13 diverse undergraduate researchers (69% women and 54% from minority groups underrepresented in STEM) between 2019-2021. Students built data-driven tools to improve diabetes management. In addition I organized a workshops on research communication, a roundtable on graduate school, and a DEI seminar on professional development.
- **Lead Mentor, Data Science Capstone Project:** Lead mentor for two teams in the Rice D2K Lab’s data science capstone projects in Fall 2019 and Spring 2020. Students researched data-driven techniques to predict post-operation cardiac arrhythmia in babies using multiple physiological signals, including electrocardiogram and blood pressure. My mentored teams won first and second prizes in successive semesters, respectively. Abstract on the work accepted at the World Federation of Pediatric Intensive and Critical Care Society’s annual conference 2020.
- **Certified Research Mentor Training Program:** Completed a certified mentorship training program organized by experts from the National Research Mentoring Network (NRMN). The program is a 6-hour evidence-based workshop aimed at postdoctoral fellows seeking faculty positions. Skills developed included active listening, constructive feedback, defining expectations, building self-efficacy, addressing equity, diversity, and inclusion, and promoting independence.

DIVERSITY, EQUITY, AND INCLUSION (DEI) ACTIVITIES

- **PATHS-UP workforce development board member:** I represent Rice University on PATHS-UP’s workforce development board (2020-present). The board plans and executes local programs for students historically underrepresented in STEM, from K-12 to university level.
- **PATHS-UP DEI seminar panelist and moderator:** Served as facilitator and panelist at PATHS-UP’s bi-annual DEI seminars on gender bias and inclusive mentoring in STEM.
- **Data science course module for underserved students:** Created a course module ”Linear regression” as part of PATHS-UP’s educational outreach for students from underserved communities. Material presented using a visual approach to simplify learning for students from diverse educational backgrounds. The module is also freely available for download on my website.
- **Guest Lecturer, PATHS-UP teachers program:** Contributed guest lectures in 2020 and 2021 to educators from Houston-area public schools as part of PATHS-UP’s Research Experience for Teachers (RET) program.

INVITED TALKS

- **“Diabetes in Underserved Communities: Data-driven Insights from Continuous Glucose Monitoring”:** Ken Kennedy Data Science and AI conference. October 2021.
- **“Revisiting the Rule of 500: Data-driven Insights into Sensor Augmented Pump Therapy”:** American Diabetes Association annual conference. June 2021.

- “**Leveraging Structure in Cancer Imaging to Predict Clinical Outcomes**”: Machine Learning in Medicine: a Virtual Seminar Series at Cornell University. May 2020.
- “**Dictionary Learning in Cancer Imaging: Discovering Visual Signatures Predictive of Malignant Transformation in Low-Grade Glioma**”: Houston Imaging Sciences symposium. October 2017.

MEDIA COVERAGE

- “**CGMs provide insight on the progression of type 2 diabetes among Hispanic adults**”: Beyond Type 2. May 2021. <https://beyondtype2.org/glucose-monitors-type-2-diabetes-hispanic/>
- “**Data science for health: Q&A**”: Rice D2K Lab Spotlight. July 2020. <https://d2k.rice.edu/news/d2k-fellow-suptik-barua/>

PEER REVIEWING

- Nature Scientific reports
- BMJ Open Diabetes
- Clinical Cancer Research
- Frontiers in Neurology
- Cancer Informatics
- IEEE Transactions in Image Processing

PUBLICATIONS

• JOURNAL PAPERS

1. **Suptik Barua**, Ashutosh Sabharwal, Namino Glantz, Casey Conneely, Arianna Larez, Wendy Bevier, and David Kerr. “The northeast glucose drift: Stratification of post-breakfast dysglycemia among predominantly Hispanic/Latino adults at-risk or with type 2 diabetes”. *Lancet EClinicalMedicine* (2021). Under review.
2. **Suptik Barua**, Raven A. Mc-New, Ashutosh Sabharwal, Nicolaas E.P. Deutz. “Discordance between postprandial plasma glucose measurement and continuous glucose monitoring”. *American Journal of Clinical Nutrition* (2021). Under review.
3. Sabharwal, Ashutosh, **Suptik Barua**, and David Kerr. “A systems approach to achieve equity in healthcare research”. *GetMobile: Mobile Computing and Communications* (2021). In press.
4. **Suptik Barua**, Ashutosh Sabharwal, Namino Glantz, Casey Conneely, Arianna Larez, Wendy Bevier, and David Kerr. “Dysglycemia in adults at risk for or living with non-insulin treated type 2 diabetes: Insights from continuous glucose monitoring.” *EClinicalMedicine* 35 (2021): 100853.
5. **Suptik Barua**, Hesham Elhalawani, Stefania Volpe, Karine A. Al Feghali, Pei Yang, Sweet Ping Ng, Baher Elgohari et al. “Computed tomography radiomics kinetics as early imaging correlates of osteoradionecrosis in oropharyngeal cancer patients.” *Frontiers in Artificial Intelligence* 4 (2021).
6. Elhalawani, Hesham, Carlos E. Cardenas, Stefania Volpe, **Suptik Barua**, Sonja Stieb, Calvin B. Rock, Timothy Lin et al. “¹⁸FDG positron emission tomography mining for metabolic imaging biomarkers of radiation-induced xerostomia in patients with oropharyngeal cancer.” *Clinical and Translational Radiation Oncology* 29 (2021): 93-101.

7. Carstens, Julienne L., Sujuan Yang, Pedro Correa De Sampaio, Xiaofeng Zheng, **Souptik Barua**, Kathleen M. McAndrews, Arvind Rao, Jared K. Burks, Andrew D. Rhim, and Raghu Kalluri. "Stabilized epithelial phenotype of cancer cells in primary tumors leads to increased colonization of liver metastasis in pancreatic cancer." *Cell Reports* 35, no. 2 (2021): 108990.
8. Kerr, David, **Souptik Barua**, Namino Glantz, Casey Conneely, Mary Kujan, Wendy Bevier, Arianna Larez, and Ashutosh Sabharwal. "Farming for life: impact of medical prescriptions for fresh vegetables on cardiometabolic health for adults with or at risk of type 2 diabetes in a predominantly Mexican-American population." *BMJ Nutrition, Prevention & Health* (2020).
9. Lazarus, Jenny, Morgan D. Oneka, **Souptik Barua**, Tomasz Maj, Mirna Perusina Lanfranca, Lawrence Delrosario, Lei Sun et al. "Mathematical modeling of the metastatic colorectal cancer microenvironment defines the importance of cytotoxic lymphocyte infiltration and presence of PD-L1 on antigen presenting cells." *Annals of Surgical Oncology* 26, no. 9 (2019): 2821-2830.
10. Reddy, Sangeetha M., Alexandre Reuben, **Souptik Barua**, Hong Jiang, Shaojun Zhang, Linghua Wang, Vancheswaran Gopalakrishnan et al. "Poor response to neoadjuvant chemotherapy correlates with mast cell infiltration in inflammatory breast cancer." *Cancer Immunology Research* 7, no. 6 (2019): 1025-1035.
11. Aung, Phyu P., Edwin Roger Parra, **Souptik Barua**, Dawen Sui, Jing Ning, Barbara Mino, Debora Alejandra Ledesma et al. "B7-H3 Expression in Merkel Cell Carcinoma-Associated Endothelial Cells Correlates with Locally Aggressive Primary Tumor Features and Increased Vascular Density." *Clinical Cancer Research* 25, no. 11 (2019): 3455-3467.
12. **Souptik Barua**, Luisa Solis, Edwin Roger Parra, Naohiro Uraoka, Mei Jiang, Huamin Wang, Jaime Rodriguez-Canales et al. "A functional spatial analysis platform for discovery of immunological interactions predictive of low-grade to high-grade transition of pancreatic intraductal papillary mucinous neoplasms." *Cancer Informatics* 17 (2018): 1176935118782880.
13. **Souptik Barua**, Penny Fang, Amrish Sharma, Junya Fujimoto, Ignacio Wistuba, Arvind UK Rao, and Steven H. Lin. "Spatial Interaction of Tumor Cells and Regulatory T cells Correlates with Survival in Non-Small Cell Lung Cancer." *Lung Cancer* (2018).
14. Carstens, Julienne L., Pedro Correa de Sampaio, Dalu Yang, **Souptik Barua**, Huamin Wang, Arvind Rao, James P. Allison, Valerie S. LeBleu, and Raghu Kalluri. "Spatial computation of intratumoral T cells correlates with survival of patients with pancreatic cancer." *Nature Communications* 8 (2017): 15095.
15. **Souptik Barua**, Yoshitaka Miyatani, and Ashok Veeraraghavan. "Direct face detection and video reconstruction from event cameras." *Applications of Computer Vision (WACV), 2016 IEEE Winter Conference on. IEEE, (2016).*
16. **Souptik Barua**, Kaushik Mitra, and Ashok Veeraraghavan. "Saliency guided Wavelet compression for low-bitrate Image and Video coding." *Signal and Information Processing (GlobalSIP), 2015 IEEE Global Conference on. IEEE, (2015).*

• BOOK CHAPTERS

1. Lehrer, Michael, Reid T. Powell, **Souptik Barua**, Donnie Kim, Shivali Narang, and Arvind Rao. "Radiogenomics and Histomics in Glioblastoma: The Promise of Linking Image-Derived Phenotype with Genomic Information." In *Advances in Biology and Treatment of Glioblastoma*, pp. 143-159. Springer, Cham, (2017).

• CONFERENCE ABSTRACTS

1. **Souptik Barua**, Angela Zhang, Ashutosh Sabharwal, Daniel DeSalvo. "218-OR: Revisiting

the Rule of 500: Data-Driven Insights from Sensor Augmented Pump Therapy”. American Diabetes Association Diabetes 70 (Supplement 1) (2021).

2. Francisco-Cruz, Alejandro, Edwin R. Parra, Santhoshi N. Krishnan, **Souptik Barua**, Mei Jiang, Junya Fujimoto, Christine B. Peterson et al. “Impact of the spatial analysis of tumor-associated lymphocytes and tumor-associated macrophages on recurrence at early stage of non-small cell lung carcinoma.” American Association of Cancer Research 79 (13 Supplement) (2019): 1180-1180.

- **DISSERTATIONS**

1. **Souptik Barua**. “Leveraging structure in cancer imaging data using data-driven frameworks to predict clinical outcomes.” PhD dissertation, Rice University, (2019).
2. **Souptik Barua**. “Rethinking Image Compression for the Object Detection Task”. Masters Dissertation, Rice University, (2015).

REFERENCES

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