SHALIN SHAH

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INTERESTS

DNA nanoscience, Computer Vision, Machine learning, Algorithms

EDUCATION

Duke University, Durham, NC (Expected Spring'20)
Ph.D. candidate, Electrical & Computer Engineering (ECE)
Graduate School Certificates: *Nanoscience*

Dhirubhai Ambani Institute of Info. & Comm. Technology (DA-IICT), India (May'15)
Bachelors of technology, Information & Communication Technology (ICT)

RELEVANT EXPERIENCE

Research assistant, Duke University (September'15 - now)
Keywords: Nanoscience | Scripting | Object tracking | Machine learning

- Designed a family of DNA-based devices which can emit unique fluorescent time signatures. This time-series data is denoised using Hidden Markov Models (HMM) and processed for pattern recognition using mean-shift clustering algorithm.

Contract software developer, Google Inc. (May'18 - August'18)
Keywords: Open-source | Java API | Maven | Travis CI | System biology

- Worked with the National Resource for Network Biology (NRNB) to improve their Java-based command-line API, SBSCL, as a part of the Google Summer of Code (GSoC) program.

Research assistant, DA-IICT (May'13 - April'15)
Keywords: MapReduce | Big data | wxPython | Tokenization | Parsing

- Built a trans-compiler, using C++, to convert simple C-like codes to chemical reactions file (represented in XML).
- Developed and implemented an algorithm to compute π using DNA as a substrate.
- Developed an algorithm to encode (and decode) data as DNA bases and implemented it, using Python, in an open source cross-platform tool called DNACloud.

Software Development Internship, Medyog (June'12 - August'12)
Keywords: Android | SQLite | Mobile application | Health care

- Worked on building the first version of Medyog, an e-commerce (Android) app which can act as a virtual pharmacist, focusing mainly on the preventive healthcare.

SELECTED PROJECTS

Driver drowsiness detection
Keywords: Unsupervised learning | Computer vision | C++ | OpenCV
Developed a model to detect drowsiness level of a driver. The model was trained for accurate classification of driver's current state.

ImPatho: An image processing tool to detect anemia
Keywords: Computer vision | k-means clustering | Windows app | C#
Built an algorithm for detecting a hemoglobin disorder and developed, ImPatho, an open-source software implementing the algorithm. This project was selected for Microsoft Imagine Cup regional finals.

Accelerating Markov random field
Keywords: C++ | OpenMP | CUDA | Psuedo-random numbers | MATLAB
Achieved up to 8x speedup for random number generation for a Monte Carlo process.

Tiger compiler
Keywords: Functional programming | ML-Lex | ML-Yacc
Developed an end-to-end compiler to convert SML-like code to MIPS assembly instructions using SML. A SPIM simulator was used to test the generated assembly code.

Carnival madness game design
Keywords: Python | Physics engine | Graphics design | Alice
Developed a 3D game using the Panda 3D game engine similar to mobile app Temple Run.

SKILLS

Programming Skills: Python, JAVA, MATLAB, C# , C++, C, SML, SQL, HTML5, CSS3
Bio-Tools: caDNAno, LBS, Visual DSD, Visual GEC.
Graphic/Design Tools: Panda3D, OpenGL, Adobe Photoshop, Adobe Premiere, Adobe Flash
Others: OpenMP, Cilk, TBB, CUDA, LaTeX , Git, SVN, Bootstrap API, Android SDK, Windows Phone SDK, Windows Store App SDK.

SCIENTIFIC INSTRUMENTS

Digital Instruments Scanning Probe Microscope, Bruker MultiMode 8 AFM, Leica Inverted Fluorescence Microscope, High Performance Liquid Chromatography, NanoDrop UV-Vis Spectrophotometer

HONORS & AWARDS

- 2018 ISNSCE best talk award, 24^{th} International conference on DNA computing.
- 2018 Duke Talent Identification Program (TIP) Stensen Klien fellow.
- 2017 best talk award, 6^{th} Duke ECE graduate student workshop.
- 2016 best poster award, 5^{th} Duke ECE graduate student workshop.
- 2015 - 2018 Duke ECE Departmental Fellowship Award.
- 2014 Microsoft Imagine Cup regional finalist.
- 2014 The Best Student Researcher, DA-IICT.
- 2014 IEEE Gujarat Section's SIGHT Conference Travel Award.
- 2012 Best App Development Prize, I-App IEEE I-Fest'12.

PUBLISHED WORKS

Abeer Eshra, **Shalin Shah**, Tianqi Song, and John Reif. "Toward Renewable DNA-based Molecular Logic Circuits." IEEE Transactions on Nanotechnology, September 2018. (In press)

Shalin Shah, and John Reif. "Temporal DNA Barcodes: A Time-Based Approach for Single-Molecule Imaging." In Proc. of the 24th International Conference on DNA Computing and Molecular Programming, Jinan, China. October 8 - 12, 2018. (**Best Talk Award**)

Sudhanshu Garg, **Shalin Shah**, Tianqi Song, Reem Mokhtar, Hieu Bui, and John Reif. "Renewable time-responsive DNA circuits." Small 2018, 14, 1801470.

Hieu Bui*, **Shalin Shah***, Reem Mokhtar, Tianqi Song, Sudhanshu Garg, and John Reif. "Localized DNA Hybridization Chain Reactions on DNA Origami." ACS nano 12, no. 2 (2018): 1146-1155.

Shalin Shah, Vijay Dhameliya, Anil Roy. "ImPatho - an Image Processing Based Pathological Decision Support System for Disease Identification and a Novel Tool for Overall Health Governance." In Proc. of IEEE Region 10 Humanitarian Technology Conference (IEEE R10 HTC), Chennai, India. August 6 - 9, 2014.

BOOK CHAPTERS

Sudhanshu Garg, Hieu Bui, Abeer Eshra, **Shalin Shah** and John H Reif. Nucleic Acid Hairpins: A Robust and Powerful Motif for Molecular Devices. Chapter in book: Soft Nanomaterials (Edited by Ye Zhang), World Scientific.

Daniel Fu*, **Shalin Shah***, Tianqi Song, and John Reif. "DNA-Based Analog Computing." In Synthetic Biology: Methods and Protocols, edited by Jeffrey Carl Braman, 411-17. New York, NY: Springer New York, 2018.

TALKS AND POSTERS

Shalin Shah. Localized DNA Hybridization Chain Reaction on DNA Origami. *Duke ECE 6th Annual Graduate Student Workshop,* Duke University, Durham, USA. September 8, 2017. (**Best Talk Award**)

Shalin Shah, Hieu Bui, Abeer Eshra, John Reif. Reversible Localized DNA Hybridization Reaction. *In Proc. of 14th International Conference on Foundations of Nano Science: Self-Assembled Architectures and Devices (FNANO),* Snowbird, Utah, USA. April 11 - 15, 2017

Abeer Eshra, **Shalin Shah**, John Reif. DNA Hairpin Gate: A Renewable DNA Seesaw Motif Using Hairpins.*In Proc. of 14th International Conference on Foundations of Nano Science: Self-Assembled Architectures and Devices (FNANO),* Snowbird, Utah, USA. April 11 - 15, 2017

Shalin Shah, Hieu Bui, John Reif. Advanced Single Molecular Imaging: Temporal Optical Signatures for a Family of DNA Devices. *Duke ECE 5th Annual Graduate Student Workshop*, Duke University, Durham, USA. September 23, 2016. (**Best Poster Award**)

Shalin Shah, Parth Dave, Manish K. Gupta. Counting Real Numbers using DNA Self-Assembly. *In Proc. of 13th International Conference on Foundations of Nano Science: Self-Assembled Architectures and Devices (FNANO)*, Snowbird, Utah, USA. April 11 - 15, 2016 (**paper**)

Shalin Shah, Dixita Limbachiya, Manish K. Gupta. DNACloud: A Potential Tool for storing Big Data on DNA. *In Proc. of 11th International Conference on Foundations of Nano Science: Self-Assembled Architectures and Devices (FNANO)*, Snowbird, Utah, USA. April 14 - 17, 2014. (**paper**)

TEACHING EXPERIENCE

Instructor, Duke TIP (Summer'18)
Modern programming: Algorithms and applications, Nanotechnology

Graduate teaching assistant, Duke University (Fall'15 - Now)
Software engineering, Random signals and noise, Algorithms paradigm, Mobile app design

Teaching assistant, DA-IICT (Fall'14 - Spring'15)
Database management systems, Android app development

SELECTED COURSES

- **Graduate** - Machine Learning, Compilers Construction, Parallel Computing, Random Signals and Noise, Image and Video Processing, Probability and Statistics for Reliability Analysis, Discrete Event Simulation, Molecular Programming.
- **Undergrad** - Coding Theory, Algorithms, Data Structures, Game design, Operating Systems, Coding Theory, Database Systems, Models of Computation, Computer Graphics.

PROFESSIONAL SERVICE

- Reviewer for international conference on DNA computing and molecular programming, Jinan, China 2018 (DNA 24).
- Reviewer and organizer for Foundations of nanoscience: Self-assembled architectures and devices (FNANO), 2017 - 2019.

REFERENCES

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