Sankalp Gambhir

Email: sankalp.gambhir@epfl.ch   sankalp.gambhir42@gmail.com

Web: https://sankalp.gambhir.gg/   Phone: +91 9654 438 430

I am in incoming doctoral student in Computer Science under Prof. Viktor Kunčak at the École Polytechnique Fédérale de Lausanne (EPFL).

My research interests revolve around automata theory, formal methods, and program analysis. I have experience researching temporal logics and verification of probabilistic and concurrent systems, and a strong background in abstract math and formal methods in CS.

education

Year	Program	Institute
Ongoing	Ph.D. Computer and Communication Sciences	École polytechnique fédérale de Lausanne (EPFL)
2022	B.Tech. Engineering Physics,	Indian Institute of Technology, Bombay (IITB)
2018	Intermediate/+2	Central Board of Secondary Education, India

research projects

Non-Markovian Inverse Reinforcement Learning   2022-Ongoing

Mohammad Afzal, *Sankalp Gambhir*, Ashutosh Gupta, Krishna Shankaranarayanan, Ashutosh Trivedi, Alvaro Velasquez

- � Formulated novel learning formalism for Non-Markovian reward function inference.

- � Adapted LTL learning techniques to Inverse Reinforcement Learning (IRL) to utilize logical specifications as reward functions.

- � Demonstrated capabilities of the technique to learn previously unexplored Non-Markovian properties in reward functions for an agent exploring grid worlds.

Quantitatively Learning LTL Specification   2019-2021

Mohammad Afzal, *Sankalp Gambhir*, Ashutosh Gupta, Krishna Shankaranarayanan

Preprint: arXiv:2110.13616 | Tool: https://github.com/sankalpgambhir/quantlearn

- � Developed a system to rank and learn LTL formulae for a set of input traces with high resilience to noise and low input size requirement compared to state-of-the-art systems presented in literature.

- � Studied structure of $\omega-$regular languages to improve algorithmic efficiency for inference.

Information Theoretic Bounds on NISQ Learning Systems   2021-2022

Advisor: Prof. Sai Vinjanampathy, Department of Physics, IIT Bombay

Bachelor's Thesis | PDF online

- � Proposed error bounds on Variational Quantum Algorithms (VQAs) arising from information-theoretic channel limits in classical control systems.

- � Established an uncertainty bound on VQA optimization for problem-specific ansatzes.

- � Studying extension to generalisation error bounds in Quantum Support Vector Machines.

key projects

Ardio - Model for realtime audio processing on low power embedded systems Fall 2020
Advisor: Prof. Pradeep Sarin, Department of Physics, IIT Bombay
Course Project, https://github.com/sankalpgambhir/ardio

- ✶ Worked in a team of two to develop an optimized Fourier Transform algorithm capable of working on low power devices such as an Arduino whilst retaining reasonable accuracy.

- ✶ Demonstrated frequency finding on live audio samples in near real-time on an Arduino Uno with less than 2KB RAM.

Petris - An FPGA based Tetris clone Spring 2020
Advisor: Prof. Pradeep Sarin, Department of Physics, IIT Bombay
Course Project, https://github.com/sankalpgambhir/petris

- ✶ Worked in a team of two to design and simulate the game of Tetris on an FPGA simulator. Used Verilog to make a state machine and created a C++ wrapper using SDL and OpenGL to handle display and I/O.

- ✶ Developed a VGA simulator using SDL2 to write the serial 'electronic' VGA output from the FPGA simulations into a low-level frame buffer.

- ✶ Developed an interface to pass keyboard presses on the computer to the FPGA via simulated electronic connections to allow for real-time input.

Logarithmic Order Long Binary Multiplication on TTL circuits Spring 2019
Advisor: Prof. Mahesh B. Patil, Department of Electrical Engineering, IIT Bombay
Course Project

- ✶ Led a team of three to devise a shift-and-add cascade for efficient digital multiplication on TTL circuits.

- ✶ Utilised asynchronous modules to achieve logarithmic time performance and achieved a scalable plug and play design to extend to larger systems.

teaching experience

- ✶ Awarded *Excellence in CSE Teaching Assistantship Award* for 'CS228M' by the CSE Department. Fall 2021

- ✶ Led a team of 10 Teaching Assistants for 'CS228M - Logic in Computer Science (Minor)' to a class of 130 students, organising tutorials and course evaluations, under Prof. Krishna Shankaranarayanan. Fall 2021

- ✶ Teaching Assistant for 'CS228 - Logic in Computer Science' to a class of 147 students, under Prof. Krishna Shankaranarayanan and Prof. Ashutosh Gupta. Spring 2021

- ✶ Held basic English and computer classes for university employees, as part of the Computer Literacy Program – NSS, IIT Bombay. Spring 2019

- ✶ Held Physics classes for the JEE for underprivileged children; prepared study material and tests for the same, as a part of the Aarohan Winter Internship Program – NSS, IIT Delhi. Winter 2018

seminars held

Eigenfunctions of Dirichlet Laplacians and Nodal Domains over Graphs Fall 2019
Department of Mathematics, IIT Bombay
Advisor: Prof. Gopala K Srinivasan, Department of Mathematics, IIT Bombay

- ✶ Discussed spectral features of the Laplacian operator and the distribution of nodes relative to the spectrum, via variational principles and via optimisation of Rayleigh quotients over H^2 space.

- ✶ Presented new insights on the multidimensional extension of Sturm's Oscillation Theorem and its application to discretized domains using graph Laplacians.

technical skills

Languages	English (native), Hindi (native)
Programming	C++, C, Python, Haskell, Bash/POSIX tools, Lustre/SCADE/Heptagon, Verilog
Packages	LaTeX, Z3, LLVM, Mathematica, AutoCAD, Solidworks

references

Prof. Viktor Kunčak
EPFL
viktor.kuncak@epfl.ch

Prof. Krishna Shankaranarayanan
IIT Bombay
krishnas@cse.iitb.ac.in

Prof. Ashutosh Gupta
IIT Bombay
akg@cse.iitb.ac.in

Prof. Sai Vinjanampathy
IIT Bombay
sai@phy.iitb.ac.in