
EDUCATION

2023 IIT Kanpur, CPI - 9.66/10

- MS(R), Cognitive Science

2021 IIT Bombay, CPI - 8.57/10

- BTech, Computer Science

2017 Anglo Urdu Boy's High School, 89.85%

- Class 12th, Maharashtra HSC

2015 Rosary High School, 94.20%

- Class 10th, Maharashtra SSC
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SUMMARY

Cognitive Science Research Experience

- 2022-ongoing MS Thesis: Demonstrated the existence of a non-index based model of multiple object tracking
- Spring 2022 Designed an experiment to investigate the disruption of same-object advantage due to top-down vs bottom-up influences
- Spring 2022 Term Paper on Homuncular Functionalism

Computer Science Projects

- Spring 2021 Development of a Tangram Solver using heuristics and CSP-solvers
- Spring 2021 dense-numericals: basic-math high-performance numerical computing library for Common Lisp
- Spring 2021 Analysis of Bakery Algorithm using nuSMV
- Summer 2020 A minimal-overhead simple-distributed-tracer for optimizing ROS-like frameworks (internship)
- Autumn 2020 Comparison of commonly used link-prediction algorithms against Adversarial Attacks
- Spring 2020 Python 2 to 3 migration and bug-fixing for BodhiTree as part of a team
- Spring 2020 Implementation of Inferencing in a Conditional Random Field for Named Entity Recognition
- Autumn 2019 Satellite to non-Satellite Image Conversion using cGANs
- Summer 2019 Binary sentiment prediction from movie reviews
- Autumn 2018 Encrypted Secure Cloud Storage with client-only keys

Common Lisp and Emacs Key Projects

- 2019-ongoing py4cl2 and py4cl2-cffi: Python libraries for Common Lisp through IPC before and CFFI now
- 2020-ongoing dense-arrays: strided dense arrays for copy-free slicing, and interchangeable backends
- 2020-ongoing polymorphic-functions: compile-time optimizable type-based dispatch functions
- 2020 smart-god-mode: combat RSI by sticky Ctrl and Meta keys, avoid Vi's mode switching annoyance
- 2021 emacs-noob: an init.el with non-emacs key-bindings for non-emacs users

Teaching Experience

- Spring 2022 Graduate Teaching Assistant for the course Computational Tools for Cognitive Science
- Autumn 2017 Teaching mathematics and information-technology as part of an NGO (LCCWA)

Other Projects and Initiatives

- 2022-ongoing Part of a team for Cognitive Science Opportunities Portal
- 2019 KNOWledge Transfer NETwork: a collection of best useful links on the internet
- 2017-2019 alterschoolindia: an attempt at a supplementary/alternative school curriculum for ages 10-14
- 2017-2018 Provision of unsolved past-year question papers for JEE Advanced

RESEARCH EXPERIENCE

Non-indexed based Computational Model of Multiple Object Tracking in humans 2022-ongoing

Prof. Nisheeth Srivastava

MS Thesis

- Developed a computational model of Multiple Object Tracking without the use of Visual Indexes in **Python**
- Accounted for previously known patterns of tracking performance in literature without making an apriori commitment to ID performance, and provided an **in-principle answer to a question open since 2004**
- Developed a **heuristic for ID performance** and obtained the empirical pattern of tracking vs ID performance

Investigating the disruption of Same-Object Advantage

Spring 2022

Prof. Devpriya Kumar (self-study course project)

- Performed a **power analysis** and **designed an experiment** to tease apart whether the disappearance of same-object advantage was due to a **disruption of object-representations** or due to **competing reaction times**.
- Conducted a **pilot study** to check the effectiveness of the design

Homuncular Functionalism

Spring 2022

Prof. Narayanan Srinivasan (term paper as part of course)

Philosophical Investigations

- Summarized Lycan's arguments against Machine Functionalism to motivate Homuncular Functionalism
- Developed an argument for why a computer simulation of consciousness can be different from actual consciousness
- Refuted Figdor's critique pertaining to the (in)sufficiency of properties of wholes explained by properties of parts

Tangram Solver using CSP

Spring 2021

Prof. Shivaram Kalyanakrishnan

RnD Project Course

- Worked in a **team of two** to formulate Tangram Solving as a **Constraint Satisfaction Problem**
- Used **opencv** to obtain contours from noisy grayscale tangram images for use in further stages of processing
- Solved **77% of the 78 contours in at most 1 second** by employing **heuristics** in the split-search procedure

KEY PROJECTS & INTERNSHIPS

Numerical Computing Library for dense-arrays: dense-numericals

Spring 2021

Prof. Shivasubramanian Gopalakrishnan (Course Project)

High Performance Scientific Computing

- Implemented C functions to efficiently operate on **strided representations of vectors** using **SIMD operations including transcendental functions** like sin, cos, tan provided by **sleef** and **intel intrinsics**
- Used foreign function interface to access these from **Common Lisp** to operate on multidimensional strided arrays
- Obtained **performance comparable to numpy** and **torch** using **lparallel** for comparing with torch

[INTERNSHIP] Optimization of ROS-like frameworks (Sony [Japan])

July 2020 – August 2020

- Developed a **simple distributed tracer** to obtain trace information with minimal throughput degradation
- Used **nodelets** and **ZeroMQ** to attempt a decrease in the publishing overheads of the framework

Analysis of Bakery Algorithm using nuSMV

Spring 2021

Prof. Ashutosh Gupta

Analysis of Concurrent Programs

- Implemented **n-threaded** Lamport's Bakery Protocol in nuSMV to study simultaneous access of critical section
- Checked **safety** & **liveness** for 2, 3 and 4 threads; studied various sections of the algorithm by introducing bugs

Satellite to non-Satellite Image Conversion using cGANs

Autumn 2019

Prof. Ganesh Ramakrishnan (Course Project)

Foundations of Artificial Intelligence and Machine Learning

- Trained a **cGAN** comprising of a **patchGAN discriminator** and a **U-net generator** to achieve the conversion
- Using **Inception Score** as the metric to compare & analyze the performance of **different variants** of the model

Adversarial Attacks on Graphs

Autumn 2020

Prof. Abir De (Course Project)

Learning with Graphs

- Compared link-prediction algorithms such as **Adamic Adar**, **Katz** against adversarial attacks like **Closed Triad Removal**, **Open Triad Creation** using common evaluation metric like **mean average precision (MAP)**
- **Identified a recurring problem** in attack algorithms wherein targeting the similarity score not affecting MAP

Conditional Random Field for Named Entity Recognition

Spring 2020

Prof. Soumen Chakrabarti (Course Project)

Organization of Web Information

- Implemented **inferencing** to obtain the best label sequences corresponding to the **named entities**
- Using **softmax**, attempted to improve **macro averaged F1 score** by introducing an auxiliary loss term

- Worked on an ongoing effort towards migrating a **40k LoC codebase** from **Django 1** to **2**, and **python 2** to **3**, qualifying url names by namespaces, removing deprecated functions, and managing the semantic change of strings
- Used **magit**, **grep** and **find** to aid code merges that arose with the parallel development of the main branch

KEY EMACS and COMMON LISP PROJECTS

dense-arrays – strided dense arrays

March 2020 – present

- Implemented an efficient **array-class metaclass** using **polymorphic-functions** to reduce slot-access times
- Provided a **protocol** for implementing dense-arrays with **multiple backends** including **CUDA** with **cl-cuda**
- Benefits over native common lisp arrays include a **cleaner more detailed display** and **zero-cost slicing** facilities through the use of **multidimensional strides** and **offsets**; and a **richer aref**

polymorphic-functions – type-based dispatch functions for Comon Lisp

September 2020 – present

- Provided **polymorphic-functions** and **polymorphs** for dispatching on specialized array types
- Made available **adhoc** and **subtype** with support for optional and keyword argument dispatch
- Implemented zero-runtime-cost **static** and **inline** dispatch possible portably using **cl-form-types**
- Used **compiler-macros** to provide relevant user-oriented messages for **compile time optimization help**

smart-god-mode – a smart “dumb” modal editing mode for emacs

January 2020

- Extended **emacs’ god-mode package** that provides one more vim-like modal editing in emacs to **prevent RSI**
- Engaged in **metacognition** to enable **seamless automatic switching** between the insertion & command modes

common-lisp.rtfld.io – easier documentation for defacto common-lisp libraries

March 2020 – present

- Used **regular expressions** to implement an **ASDF** system to **parse** documentation strings into a markdown file
- Worked towards **simplifying the official documentation** to obtain a more friendly **getting started** sections on several libraries like postmodern, quicklisp, asdf, cl-ppcre; currently hosting **10+ libraries** using **mkdocs**

emacs-noob – beginner-oriented init.el for emacs

Jan 2021 – present

- Provided a **init.el** designed for **using emacs for common lisp without learning emacs** key-bindings
- Used **tabbar-mode**, **goto-chg**, **company-mode** to provide out-of-the-box support for **SLIME** for common lisp

py4cl2 – python libraries for common lisp

June 2019 – present

- Imported **python function signatures** and enabled **asynchronous output** in an **open source** project **py4cl**
- Obtained a **30-times speed up** in large array transfers using pickling; also array-element-type preservation
- Used **semaphores** and **macros** to construct **with-python-output** to obtain python output as a string
- Enabled **embed-ability into lisp image** by storing the python part of **py4cl2** into a variable
- Improved **documentation** and started **versioning** and maintaining **releases**; currently a maintainer of **py4cl2**

OTHER PROJECTS

Sentiment Prediction from Movie Reviews

Summer 2019

- Used **word embeddings** to obtain user sentiments from movie reviews using **keras** and **numpy**
- Obtained **88% accuracy** on **IMDB movie review dataset** using a **multi-layer perceptron**

KnowTNet – a collection of best useful links from the internet

December 2019

- Used **hunchentoot**, **parenscrip**, **clsql** (ORM), **cl-markup** to implement the **full stack**
- Used **argon2** to hash passwords in a **GPU & ASIC resistant manner**; provided abilities for **persistent login**
- Also implemented a reduced feature version of the website using **JAMStack** using **local storage** and **React**

Secure Personal Cloud

Autumn 2018

Prof. Soumen Chakrabarti (course project)

Software Systems Lab

- Developed an encrypted cloud storage with client-only keys stayed to provide true data privacy using **Django**
- Used **node.js**, and **browserify** to implement decryption on the webclient using **CryptoJS** library.
- Used the bash tools – **curl**, **inotifywait** to create a linux-client, with **single-client livesync** capabilities

3D Tic Tac Toe

Spring 2018

Prof. Amitabha Sanyal (course project)

Abstractions and Paradigms of Programming

- **Encapsulated** and **abstracted the board** using **object oriented programming**
- Used **higher ordered functions** to implement a function to determine whether the current state is a win.
- Implemented **minimax algorithm** as the AI agent in the game.
- Used **racket/gui** library to implement the game as 4 2d Boards and git for version control.

Contention Resolution and Switching

Spring 2019

Prof. Ashwin Gumaste (course project)

Digital Logic Design

- Implemented Contention Resolution and Switching module of a router in VHDL using Xilinx ISE
- Created and implemented state diagrams for reading and writing data to FIFO based **Virtual Output Queues**
- Used Separate Virtual Output Queues for each input port to avoid head of line blocking
- Implemented **round-robin** based state diagrams for **Arbiter** for scheduling while accounting for **express ports**

Android Development

Summer 2019

- Added a **tablet mode** to the android app **bVNC** (a VNC viewer application), using **onTouchEvent**, to provide simultaneous support for **single finger scroll**, **long tap and drag** to select and **long tap** to right click
- Added **unicode math symbols** and **del** key to the open source android app **Hacker's Keyboard**

Miscellaneous

2017-20

- Implemented **Davis-Putnam-Logemann-Loveland** in racket to solve the boolean satisfiability problem
- Used **Deterministic Finite Automata** to construct a regular expression matcher
- Experimented with **multithreading** in Java to determine when multithreading is useful
- **reader** – lisp library for providing **reader macros** for lambdas, hash-tables, hash-sets, accessors, arrays.

ACADEMIC ACHIEVEMENTS

- Within national **top 1%** in **Cognitive Science Joint Entrance Test (COGJET)** (2021)
- Selected for **Chennai Mathematical Institute's** B. Sc. (Honours) Mathematics Course (2017)
- Secured AIR 700 amongst 2 lakh candidates in JEE (Advanced) (2017)
- Secured AIR 1120 amongst 1.2 million candidates in JEE (Mains) (2017)
- Within national **top 1%** in **National Standard Examination in Physics** (2017)
- Selected for the award of scholarship in **National Talent Search Examination** (2015)
- Selected for the award of scholarship in **Kishore Vaigyanik Protsahan Yojana** (2015)

KEY COURSES

Philosophy	Introduction to Philosophy, Philosophical Investigations (Philosophy of Mind)
Cognitive Science	Introduction to Psychology, Human Cognitive Processes, Cognitive Psychology, Cognitive Neuroscience, Neuroscience of Learning & Memory, Computational Cognitive Science, Topics in Visual Perception*
Machine Learning	Data Analysis & Interpretation, Learning with Graphs, Organization of Web Information, Artificial Intelligence & Machine Learning, Foundations of Intelligent & Learning Agents
System & Softwares	Software Systems Lab, Design & Analysis of Algorithms, Analysis of Concurrent Programs, Operating Systems, Foundations of Network Security & Cryptography, Computer Architecture
Others	Economics, Environmental Ethics

*would be completed by April 2022

OTHERS

- Poster Presentation on Multiple Object Tracking without Indexes at the ACCS-10 conference (2022)
- Teaching Assistant for a Programming Course at the Cognitive Science Department: conducted tutorial sessions and evaluated assignments while accounting for students with diverse technical and non-technical background (2022)
- Discovered RAM Manager for Magisk to **fix aggressive app killing** on android (2019)
- 1200+ Karma on r/lisp; 466 reputation on Stackoverflow; 171 reputation on AskUbuntu (2017-ongoing)
- Tinkered with **Custom ROMs** and **rooting**, to extend the useable life of my smartphone and tablet (2017-19)
- Compiled a list of **Learning Points** from the **anime** Digimon Adventures and Naruto (2017-19)
- Created a repository of free **JEE Advanced Unsolved papers** – solved are available everywhere (2017-19)
- Under National Social Service scheme: **taught underprivileged kids** at an NGO (LCCWA); **recorded hindi news audio books**, as part of Voice for Purpose (2017-18)
- Studied **myopia** to understand its cause and methods of prevention / cure (2017)