Manas Kale

manas96 | ManasKale | manas96.github.io

Education

Master of Science (Thesis) - McGill University

Montreal, Canada

Computer Science

2021 - 2023 (expected)

Supervisor: Paul Kry

Bachelor of Engineering - Pune University

Pune, India

Computer Science and Engineering

2014 - May. 2018

First class with distinction

Work experience

Research Intern - Huawei Canada

Montreal, Canada

Bullet simulation framework, C++, Python, Rigid body simulations

2022 - Present

- Research on distributed physics processing for large-scale simulation.

Data Scientist - Infinite Uptime

Pune, India

Python (Apache Kafka, scikit-learn, HoloViews), C++ (Embedded FFT libraries), Java (Apache Flink), Fourier analysis, Streaming analytics

February 2019 - February 2021

- Significant productionized contributions to embedded edge computation device (***C++***), analytics algorithms (***Python***) and data processing backend (***Java***).
- Overhauled previous batch processing pipeline for edge device data. Architected and implemented an extensible real-time data processing pipeline (***Apache Flink - Java***), improving throughput by 200%, reducing infrastructure cost and lowering latency.
- Proactively created library for exploring and visualizing data in a Jupyter notebook (***Python - HoloViews***), improving data analytics workflow.
- Conceptualized and implemented automated thresholding by using ***constraint solvers (Python - SciPy)***, saving tedious man-hours per customer.
- Volunteered and fixed critical stability issues for embedded device's WiFi (***ESP8266 chip, C++, MQTT protocol***) firmware.
- Implemented extensible ***serialization data format*** for transmitting edge device's FFT data (***C++***), reducing size of typical data packet by ***3x***. Wrote server side deserialization library in ***Python***.
- Improved edge device's FFT (***Fast Fourier Transform***) sampling block size from ***512 to 4096***, improving frequency resolution ***from 6Hz to 0.2Hz*** while working under tight memory constraints. Wrote ***extensive documentation (C++)*** for the previously undocumented codebase.
- Contributed to writing an automated firmware flashing script (***bash***), saving thousands of man-hours.
- Improved embedded dev workflow by introducing new tools. Customized VSCode IDE for embedded team's ***C++*** development environment, formalized version control (***git***) and software release strategy.
- **[Patent publication, Indian Patent Office]** "SYSTEM AND METHOD FOR SEGMENTING TRANSMISSION OF DATA", Application No.202021020386 A

Associate Software Engineer - NICE Interactive Solutions

Pune, India

Java (Spring framework), JavaScript (AngularJS), Amazon AWS, Git, Agile

July 2018 - January 2019

- Part of team responsible for ***Tenant Management*** microservice - a service which handles creation, maintenance, billing and license/subscription tracking of third party vendors on NICE's CXOne cloud platform.
- Implemented new features per business logic using ***Spring*** framework and ***AngularJS*** in an agile project management environment.

Intern - Tata Consultancy Services

Pune, India

IBM Maximo, Python, Websockets, REST API, JavaScript, HTML Bootstrap

2 June - 28 July 2017

- Made a full stack webapp to monitor asset data in real time, detect anomalous data and issue warnings.
- Implemented server (***Python2***) to pull data from IBM Maximo's REST API and broadcast through ***websockets***.
- Implemented webpage UI (***HTML bootstrap***) to track assets on a map and provide real time graphs for each sensor, issuing alerts in case of anomalous data.
- **Project report :** manas96.github.io/internship_report/

Projects

Raytracer

C++ (OpenGL Mathematics, OpenMP)

May. 2019 - Present

- **Source code & screenshots :** github.com/manas96/Raytracer
- A backwards raytracer written for learning purposes.
- References used: **Ray Tracing in One Weekend** by Peter Shirley and **Physically Based Rendering, from Theory to Implementation** by Pharr, Jakob and Humphreys.
- Implemented ***Monte Carlo Path Tracing*** and optimized using ***Bounding Volume Hierarchies*** and ***OpenMP*** parallelization.
- Additional features: mesh loading from ***.OBJ*** files, real-time raytraced image visualization, depth of field, physically based materials.
- ***[Open Source Contribution]*** Contributed to improving all three of ***Peter Shirley's Ray Tracing in One Weekend*** book series: https://raytracing.github.io/books/RayTracingTheRestOfYourLife.html#acknowledgments

Satellite tracking ground station for SatNOGS network

RaspberryPi, software-defined radio

March. 2019

- Assembled & calibrated radio antenna and configured software defined radio (SatNOGS) on Raspberry Pi to track and collect data from **MOVE-II cubesat**.
- Sole maintainer of station **mumbai-gs** on the SatNOGS crowd-sourced satellite data collection network.

3D Game Engine using OpenGL

OpenGL, Java (LWJGL), GLSL Shaders *June. 2017 - September 2018*

- **Source code and screenshot(s):** github.com/manas96/3D-gameEngine-v2
- An ***interactive*** 3D rendering engine using ***OpenGL*** API (through LightWeight Java Game Library).
- Implemented features: • ***Lighting (ambient, point)*** • ***OBJ geometry file loader*** • ***Fog blending*** • ***Entity system architecture*** • ***Collision detection*** • ***Particle system*** • ***Skybox*** • ***Raycasting*** • ***Normal mapped textures*** • ***Fresnel reflection shader***

Improving Human-Computer Interaction with Machine Emotion Intelligence using NAO Robot (Bachelor's Thesis Project)

Python (Flask, Scikit-learn, OpenCV), Machine Learning (SVM, multinomial NB, DNN), JavaScript (Bootstrap, HighCharts.js) *June. 2017 - June 2018*

- A novel approach to determine user's emotion using a ***weighted sum*** of the following inputs: ***facial features***, ***spoken text*** and ***voice characteristics(tone)***.
- Used ***IEMOCAP*** dataset to train a ***DNN*** (Deep Neural Network) for tone module, ***Cohn-Kanade*** dataset for training a ***SVM*** (Support Vector Machine) for facial module and ***IEMOCAP*** to train a ***multinomial NB*** (Naive Bayes) classifier for spoken text module.
- Each module's ***confidence score*** along with its ***weight*** was used to calculate final emotion. Weights were adjusted dynamically based on quality of input and confidence score.
- Our (team of 4) algorithm was able to perform better using dynamically adjusted weights when compared to individual modules.
- Contributed to the facial module, weight adjustment algorithm, webpage UI and web server.
- **Detailed project report :** manas96.github.io/project_thesis.pdf

Open source contributions to MovingBlocks organization

Java (libGDX), Gradle, Git *March. 2018*

- Fixed bugs for Terasology(a 3D voxel engine) and DestinationSol(a 2D space shooter).
- **Terasology link** : github.com/MovingBlocks/Terasology/pull/3275 • **DestinationSol link** : github.com/MovingBlocks/DestinationSol/pull/252

Research & Publications

Driver profiling using realistic racing games

C++ (SDL,OGRE3D), Python (scikit-learn, matplotlib), Machine learning (SVM,KNN,NB) *March 2017 - April 2018*

- Identified different (video game) drivers by logging keypress events and training various classifiers on this data.
- Edited source code of an open source 3D racing game, **StuntRally** (***C++***) to log keypresses. Cleaned, normalized and created a custom feature vector from this log data(***scikit-learn***). Trained ***KNN***, ***SVM*** and ***NB*** classifiers on this data and found ***SVM*** performed best.
- **M. Kale and M. V. Bedekar, "Driver Profiling Using Realistic Racing Games", 2018 Second International Conference on Inventive Communication and Computational Technologies (ICICCT), Coimbatore, 2018, pp. 13-17. doi: 10.1109/ICICCT.2018.8473154**
- **Pdf link :** manas96.github.io/driver_profiling.pdf

Achievements

Certificate of Appreciation from Infinite Uptime

For proactive work on fixing critical edge device issues & creating extensive documentation *May 2019*

1st Runner Up in SmartIndia Hackathon 2017

C++, OpenCV, NVIDIA CUDA, QT framework *April 2017*

- Led a team of 5 in a national level non-stop 36 hours hackathon with 351 participating teams. Problem statement: **create real-time video stabilization software for use on Unmanned Aerial Vehicles.**
- Implemented a working prototype in 36 hours using **OpenCV (C++)** for video processing and optimized that with **NVIDIA CUDA** bindings for near real time video stabilization.
- Personally contributed to stabilization algorithm optimizations using **OpenCV's CUDA** bindings.

Extracurricular Activities

Led and organized teams in conducting DOTA2 tournaments

Aarohan festival(2016) - MITCOE & Texphyr festival (2018) - MIT Pune *March 2018 & January 2016*

Advocated for and organized national level college e-sports tournaments for ***DotA2***, a multiplayer online battle arena game I am passionate about.

Conducted hands-on practical session on data recovery, file carving for class students of MIT Pune

Kali Linux, Foremost file carving tool *August 2016*

Explained file carving process along with demonstration.

Skills & hobbies

Languages: C++, Python, Java
Graphics: OpenGL, OpenCV, OpenGL Mathematics (GLM), GLSL
Visualization: HoloViews, Bokeh, Matplotlib
Data science: Numpy, Scikit-learn, Pandas
Big data: Apache Flink, Apache Kafka, Redis
Web frameworks: Flask **Tools:** Git, LaTeX, Doxygen