Shrishailya Chavan

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EDUCATION

Worcester Polytechnic Institute - *Worcester*, MA — Aug 2022 - May 2024
Masters in Mechatronics, Robotics and Automation Engineering — GPA: 4.0/4.0
Relevant Coursework: Deep Learning, Machine Learning and ROS, Computer Vision, Swarm Intelligence, Medical Robotics, Motion Planning, Controls

Vishwakarma Institute of Technology - *Pune, India.* — Aug 2018 - July 2022
Bachelor of Technology in Mechanical Engineering — CGPA: 8.65/10

TECHNICAL SKILLS

Programming Languages: C++**,** Python, Java, ROS, MATLAB, Lua
Deep Learning Frameworks: TensorFlow, PyTorch, Keras
Programming Libraries: Pandas, NumPy, Scikit-learn, CUDA, OpenCV, seaborn, GDAL, SciPy
Tools: PyTest
CAD Software: SolidWorks, AutoCAD, CATIA, Fusion360
CAE Software: Ansys
Other Software: CoppeliaSim, Gazebo, Scilab Xcos
Databases: MSSQL, MySQL
Platforms: Amazon Web Services (AWS)
Configuration Management: Git

Deep Learning Architectures: ResNET, ResNEXT, DenseNET, VGG16, HomographNET, Sfm Learner, U-Net, Filter Banks (Oriented DoG, Leung-Malik, Gabor, Texton, Brightness, Color map, Sobel and Canny baselines)

PROFESSIONAL EXPERIENCE

Triple Ring Technologies, Boston, MA *(Machine Learning Research Intern)* — **June 2023 - Sept 2023**

ChemGPT- Chemical Chat Generative Pre-Trained Transformers

- Developed a **real-time chemical query chatbot leveraging LLM** for inquiries on molecular densities, chemical names, formulas, and abbreviations. **Created and managed** a comprehensive chemical **database** comprising **2 million rows**.
- Data Collection: Used **APIs and web scraping to gather** raw chemical data.
- Data Processing: Employed advanced techniques like **cleaning, normalization, and tokenization to prepare data** for integration into the database.
- Employing LLM: Leveraged MarkupLM (an LLM variant) for **enhanced HTML data extraction**, complemented with NLP for proficient query handling.
- Programming & Deployment: Utilized languages and libraries such as Python, Java, and NumPy to build, test, and deploy the system.
- Continuous Learning: Kept **abreast with the latest NLP and LLM advancements**, and p**resented working prototypes demonstrating** the applied solutions.
- The **LLM-powered chatbot drastically streamlined** chemical data inquiries, reducing extensive manual search time to mere seconds. The database I built became a pivotal resource, offering accurate and swift chemical information retrieval.

Deep Learning Acceleration of CT Dosimetry Simulations for Medical Devices

- Developed the MCDNet, a neural network to **accelerate Monte Carlo simulations for medical devices** CT dosimetry, addressing x-ray CT radiation concerns.
- Leveraged anatomical voxel phantoms and a **GPU-based** Monte Carlo code for data generation. **Assessed predicted dose maps** using the Gamma index passing rate (GIPR).
- **Achieved a 76× speed-up in simulations**, introducing a novel use of CNN for MC radiation simulations with 3D medical devices for x-ray CT. Future potential for broader radiation transport applications.

Predictive ML Modeling for Radiation Sterilization Dosimetry in Medical Devices

- Developed a **Machine Learning based predictive tool** for radiation dose mapping in medical device sterilization.
- Reviewed relevant sterilization literature. **Utilized CAD models** for initial dose predictions. Designed and t**rained an ML model** using custom radiation simulations, data preprocessing techniques, including cleaning, normalization, and tokenization. **Streamlined the process** through documentation and application of best practices.
- Streamlined sterilization validation, reducing traditional inefficiencies. Facilitated early-stage design decisions for optimal sterilizability. **Enhanced simulation prediction speed, optimizing the product development cycle**.

Medical Fusion Lab, WPI, Worcester, MA ***(Graduate Student Researcher)*** — **Nov 2022 - April 2023**

Tumor boundary extraction from Photo-acoustic prostate imaging

- Processed tumor ultrasound data, **trained a U-Net model** for mask prediction, conducted 3D tumor reconstruction, and applied **advanced visualization** and **morphological techniques** to the predicted data.
- Extracted frames from tumor videos, performed **binary segmentation** in MATLAB, and trained a U-Net model on the resulting dataset. Utilized the **predicted masks for 3D tumor reconstruction in MATLAB** and employed FIJI visualization and morphological operations for refined analysis.
- Approach enhanced tumor morphology understanding, potentially **improving diagnosis and treatment planning**. Visualization and morphological operations provided **comprehensive tumor analysis**, supporting future oncology research and clinical applications.

HERB-Lab, WPI, Worcester, MA *(Graduate Student Researcher)* — **Nov 2022 - April 2023**

Classification of thermal anomalies using deep learning and **Vision Transformers (ViT)** to Convolutional neural networks (CNNs)

- Web Scrapped and collected the data for image facades and labelling them.
- Working on **Masked Image Modeling** to understand architecture age and style through Deep Learning.

ACADEMIC PROJECTS

- **Einstein Vision** — **April 2023**
  - Developed an **advanced autonomous vehicle dashboard visualization system** with essential features, advanced capabilities, and extra cognitive abilities.
  - Utilized **pre-trained computer vision models, depth estimation, pose estimation, and creative techniques** like color thresholding to identify and render various elements in the scene **using Blender**.
  - Visualization system **improved human-robot interaction**, trust-building and enabled better decision-making for the autonomous vehicle, enhancing user experience and safety.

- **Visual Intertial Odometry** **April 2023**
  - Applied the "Robust Stereo Visual Inertial Odometry for Fast Autonomous Flight" paper on the EuRoC dataset's Machine Hall 01 subset. This dataset consists of **quadrotor trajectory data** with ground truth from a Vicon Motion capture system.
  - Developed a deep learning approach for **stereo SLAM** (Simultaneous Localization and Mapping) by predicting relative pose between image frames and IMU measurements. Trained the neural network on the **EuRoC dataset's**. Compared the performance of vision-only, inertial-only, and visual-inertial data predictions.
  - Resulting **stereo visual-inertial fusion system** enables fast autonomous robot navigation in challenging environments. The combination of classical and deep learning approaches improves stereo **camera pose estimation accuracy** and **handles** common issues like **motion blur and drift**. This technology has significant implications for **advanced robotics, particularly in aerial robotics and autonomous vehicles**.
- **Auto Pano**
  - Panorama **image stitching** using traditional and deep learning approach to find homography between two images.
  - Implemented traditional CV pipeline combines algorithms of **corner detection, ANMS, feature extraction, feature matching, RANSAC, homography estimation and blending**.
  - In Deep Learning, used **Homography Net** (both supervised and unsupervised) to estimate the homography.
- **Building built in Minutes - SfM and NeRF**
  - Reconstructed a 3D scene and simultaneously obtained the camera poses of a monocular camera from a set of images with different view points using feature point correspondences (classical CV).
  - Implemented pipeline consisted of algorithms to find **Fundamental and Essential Matrix, triangulation of 3D points** (using Epipolar geometry), Perspective-N-Point (3D-2D PnP) and **Bundle adjustment**.
  - Used Neural Radiance fields (NeRF) to synthesize novel views of complex scenes by optimizing a continuous volumetric scene function using a sparse set of input views (Deep Learning).
- **Auto Calib :** Implemented **Zhang's camera calibration** technique with non-linear optimization.
- **Factored Solution to the Simultaneous Localization and Mapping(SLAM) Problem with Unknown Data Association** **Jan 2023**
  - Developed and implemented the **FastSLAM algorithm**, a novel approach addressing SLAM limitations in **EKF-based methods**.
  - Introduced **FastSLAM 2.0**, incorporating observations into the **proposal distribution for diverse samples** and **improved accuracy**.
  - **Achieved superior performance** in large, ambiguous environments with f**ewer samples**, enabling effective people tracking in **dynamic scenarios**.
- **Language Translator using Seq2Seq Model(RNN),** *Python, Keras* **Sept 2022**

  Build and devise a high performing machine translation sequence to sequence model(RNN) that will accept English text as input and return the French translation
  - Supervised **model development, processing of text data** to feed it to the network pipelines, testing and validation of translated output text streams.
  - Developed a **Recurrent Neural Network and fully-connected layer** to accept and process the sequence of words respectively.