Yashwardhan A. Deshmukh

Final Year Undergraduate Student

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Personal Statement

Diligent and passionate individual with high executive functioning skills. Self-motivated and strongly interested in research in machine learning (DL, RL), human-computer interaction, haptics, robotics and computer vision.

Publications

Research Papers

[*C1*] **Yashwardhan A. Deshmukh**, Katherine J. Kuchenbecker, Gokhan Serhat. Deform-AI-tion: Neural-network accelerated simulations for fingertip deformations. (*In Progress, Target: CHI '24 Conference on Human Factors in Computing Systems)*

Technical Articles

[*T1*] **Yashwardhan A. Deshmukh**, On Device Machine Learning: Train And Run TensorFlow Lite Models In Your Flutter Apps. *Google Cloud - Community, [Link], 40k+ Views, January 2021*

[*T2*] **Yashwardhan A. Deshmukh**, Easy Ways to Pass and Receive Data With Flutter Stateful and Stateless Widgets or Pages. *The Startup, [Link], 80k+ Views, January 2021*

Education

- **NMIMS' Mukesh Patel School of Technology, Management & Engineering** — *Mumbai, India*
  Bachelor of Technology in Computer Engineering; CGPA: 3.5/4.0 — *June. 2019 - Aug. 2023*
- *Summer Schools*
  - **MLSS 2021 Taipei, Machine Learning Summer School** — *(Remote) Taipei, Taiwan*
    MOST Joint Research Center for AI Technology and all Vista Healthcare — *Aug. 2021 - Sep. 2021*
  - **5th Summer School on Artificial Intelligence and Computer Vision** — *(Remote) Hyderabad, India*
    CVIT, International Institute of Information Technology, Hyderabad — *Aug. 2021 - Sep. 2021*

Research Experience

Max Planck Institute for Intelligent Systems — **Stuttgart, Germany**

- *Haptic Intelligence Department, directed by Katherine J. Kuchenbecker*
  Research Intern, Mentor - Gökhan Serhat — *Nov. 2021 - Present*
  - Developed a physics-informed (*PINN*) multi-input multi-output regression based surrogate **neural network** model, to approximate the mechanical behavior of soft tissues of a human fingertip under static loading conditions, which showed strong correlation (validation MSE: $4.99e^{-6}$) with its ground truth, the finite element mesh simulation.
  - Built a python library to plot and render 3 dimentional meshes from MATLAB's patch function into python.
  - Generated training data by running a finite element simulation in Matlab, varying the input parameters to capture a wide range of deformation behaviors.
  - Trained and evaluated 42 different variations of the model's hyperparameters, for optimizing accuracy and computational efficiency, by using Keras' bayesian optimization, grid search, and manual probability space search as hyperparameter tuning methods.
  - Deployed the model by developing a website using JavaScript, TensorFlow.js, and plotly, where researchers can choose a node and input desired amplitude value to instantly visualize the predicted deformed 3D Mesh plot of the fingertip.
  - Presently working on extending the model's capacity to handle time-varying frequency response dynamic cases by incorporating frequency and damping as additional parameters to train a Long Short-Term Memory (LSTM) network.

- **Université du Québec** — **Chicoutimi, Quebec, Canada**
  MITACS Globalink Research Intern — *May. 2022 - July. 2022*
  - Worked on model hyperparameter tuning of temporal sequence data for human computer interaction components for safety of construction workers
  - Evaluated accuracy based on metrics of mean, kurtosis, skewness and standard deviation after forming futures of data, then tested samples using machine learning algorithms such as naive bayes and principle component analysis

- **Trinity College of Engineering and Research** — *Pune, India*
  Research Intern, Advisor - Harshada Jadhav — *Aug. 2021 - Present*
  - Working on multi-camera object tracking for a robot vision system.

- **Orbitx India Aerospace Pvt. Ltd.** *Pune, India*
  Research Intern, Mentor - Pratik Wele *May. 2021 - Aug. 2021*
  - **Reusable Launch Vehicle (RLV-Rocket) Team**: Researched on supersonic combustion ramjet engine's module and dynamics. Contributed my research through an article on aerodynamic performance of hypersonic shuttles.
  - **Hypersonic Work**: Simulated hypersonic flow through hy2Foam, a computational fluid dynamics (CFD) solver.

Industrial Experience

- **Fiat Chrysler Automobiles N.V.** *Pune, India*
  Software Intern, Advisor - Prakash Singh *Apr. 2021 - May. 2021*
  - **Corporate Division**: Revamped the visualization support for the project 'finance decision support dashboard'. Researched and presented ways of tackling problems with analytical solutions.
- **FinBits India LLP** *Mumbai, India*
  Director, Lead Developer *Jan. 2021 - Present*
  - iOS AppStore: [Link]; Android PlayStore: [Link]
  - **My Work**: Developed an asynchronous, scalable and cross-platform Flutter application with an inbuilt recommendations engine built using TensorFlow Recommenders and approximate nearest neighbours algorithm. My application behaves as a free learning-focused platform with a vision of making young India financially literate by providing daily financial insights, newsletters and stock suggestions.
  - **Leadership**: Mentored over 30 people, which included a group of senior undergraduate students, under their technical internship program, on building and deploying robust and large-scale cross-platform applications.

Projects

- **TestGeN.ai — Question Generation Platform** *[GitHub] (NLP, Transformers, PyTorch, Javascript, PHP, Ajax)*:
  A host can input a paragraph of words and and the platform then generates different types of quizzes from it. For this, keywords were extracted from the paragraph using unsupervised keyphrase extraction with multipartite graphs, which were then passed to a system that employs a transformer model that is finetuned using transfer learning on the SQuAD dataset, using the T5 model and tokenizer to generate questions pertaining to the extracted keyword. Using sense2vec, Normalized Levenshtein distance algorithm and Maximal Marginal Relevance algorithm (cosine similarity), dissimilar distractors were generated to create incorrect options for the question. Using BERT overcame word sense disambiguation for distractor sense classification. Flask was used as the Python app to generate the tests, while Ajax was employed as a handler between the website and the question generation models. JavaScript was used for client-side scripting.

- **BrainStain.ai — Brain Tumor Segmentation & Alzheimer's Detection** *[GitHub] (Tensorflow, U-Net, NIfTI)*:
  Currently implementing self supervised Vision Transformer, Equivariant Transformer and Siamese Network models for representational learning on ADNI Alzheimer's Dataset. Trained a neural network model based on the U-Net architecture to predict segmentation masks for edema, non-enhancing, and enhancing tumors on the BraTS dataset. Data preprocessing was done by removing the feature lacking volume slices of the NIfTI files. Sørensen–Dice index was used as the evaluation metric to calculate the difference between the predicted overlap and the ground truth segmentation mask.

- **Seventh-Sense — An Obstacle Detection App for Visually Impaired** *(TensorFlow, Keras, Flutter)*:
  Deployed a COCO mobilenet-SSD TensorFlow Lite model into a Flutter App to detect 90 real world objects in real time using native device camera while giving multilingual audio feedback. Currently working on 3D Visualization using Geometric Deep Learning on LIDAR output and ROVIO stack, a package collection for ROS (Robot Operating System).

- **CovCT — On-device Covid Detection** *(TensorFlow, Keras, Flutter)*:
  Trained a CNN through transfer learning to for pneumonia detection and malignancy detection. Worked on building a segmentation model to isolate the lung region from the rest of the X-ray. Deployed the model on a mobile phone using Flutter for On-Device classification.

- **StraysCU — Stray Animal Violence Prevention** *[GitHub] (Flutter, Firebase, Google Cloud Platform)*:
  Projects aims to protect our planet, by working with United Nations' 2nd, 3rd & 15th sustainable development goal, for which I developed a large-scale cross-platform application to save stray animals and prevent stray violence/brutality by building a self-sustaining community of like minded animal enthusiasts, with features such as instantaneous geolocation stray help support, case report forms, animal fostering and adoption, verified city-wide NGO & Caretaker support, authentic stray cure education guides and resources, ability to filter cases using geocoding.

Extracurricular Activities

- **Martial Arts: International Athlete in GojuKai Karate** *(Black Belt, Japanese Shodan)*:
  Won over 25 Gold Medals in National Tournaments and a total of over 40 Medals & Certificates. Also qualified for, and played at the 6th All World International GojuKai Karate-Do Championship. Passionately trained for 7 years, attended a total of 10 National Camps, and placed first at the Mumbai Mayor Cup.

- **Musician** *(Professional Guitarist)*:
  Achieved 92% Grade from Furtados School of Music, after which I have been self-educating myself for over 7 years.

Social Work

- **Dream Social Foundation** *Rural Areas, India*
  Summer Social Worker, Paani Foundation *May. 2019 - Aug. 2019*
  - **Satyamev Jayte Water Cup 2019**: Worked on implementing natural water harvesting and watershed management techniques. This project successfully resulted in providing clean water to over 4700 rural villages in India.
- **Social Impact, Students Council** *Mumbai, India*
  Executive *Aug. 2019 - Nov. 2019*
  - **Blood Donation Drive**: Brought donors from college campuses and helped promote the overall cause.

Programming Skills

- **Proficient Languages**: Python, Dart, JavaScript, MATLAB
- **Technologies**: TensorFlow, Flutter, Keras, OpenCV, Firebase

Other Achievements and Talks

- **MITACS Globalink Research Internship, 2022**: Awarded a $8000 scholarship grant to do research in deep learning and human-robot interaction at Université du Québec à Chicoutimi, Canada during the summer of 2022.
- **Invited Talk at the Indian Institutes of Science Education and Research on demystifying research internships**: The goal of the talk was to motivate young minds to pursue scientific research, by talking about concepts of deep learning and my research progress at Max Planck Institute for Intelligent Systems
- **NMIMS' Computer Vision Research Group**: Selected to work as a part of the university research group.
- **Public Relations Head for University Tech Fest**: Elected to represent the public relations team said due to my leadership, team work and confident public speaking skills.