KUNAL KOTKAR

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SKILLS

- **Languages**: Python, Java, C/C++, C#, JavaScript, HTML/CSS, Kotlin, SQL
- **Libraries & Frameworks**: OpenCV, PyTorch, Scikit-learn, Pandas, NumPy, Matplotlib, TQDM, TensorFlow, NNI, Bootstrap, ReactJS, Angular, NodeJs, Flask, HuggingFace, PyDicom, Firebase, ARUCO
- **Software Tools:** Docker, CVAT, GPUs, MATLAB, Git, AWS (EC2, S3), Unity, MongoDB, MS Excel, Robotic Operating System

PROFESSIONAL EXPERIENCE

Computer Vision Engineer | Surgical Vision Systems, Inc., Baltimore   *July 2024 – Present*
- Created a dataset of **7,800+** surgical instrument images using an Astra 2 camera capturing color and depth; trained YOLOv11 and SAM2 models, achieving **93.6%** mAP50 detection accuracy.
- Enhanced the surgical robotics pipeline by developing ROS2 Iron nodes integrated with SAM2, GroundingDINO, and SegFormer; implemented pick-and-place operations enabling precise instrument manipulation.
- Conducted hand-eye calibration and integrated ArUco marker detection into the robotic system, improving positional accuracy and reliability during surgical instrument handling.

Machine Learning Research Assistant | HEPIUS Innovation Lab, Baltimore   *Jan 2023 – May 2024*
- Generated and managed a medical imaging dataset from DICOM files; deployed deep learning models (YOLOv8, DETR, SSD) achieving **99.5%** detection accuracy at up to **58** frames per second.
- Developed segmentation models (SAM, TransUNet, DeepLabv3) for automated spinal cord anatomy segmentation tasks, attaining a mean Intersection-over-Union (IOU) accuracy of **82%**.
- Built a Dockerized AWS cloud environment enabling medical professionals to efficiently utilize the Computer Vision Annotation Tool (CVAT) for generating accurate ground truth annotations.

Machine Learning Intern | Knowledge Solutions India, Pune   *May 2020 – June 2020*
- Designed and applied Regression, Random Forest, and K-Means (5 clusters) on proprietary datasets to support data-driven decisions in a movie recommendation task.
- Built an advanced Movie Recommendation System using K-Nearest Neighbors to boost user experience and engagement.

EDUCATION

Johns Hopkins University | Master of Science in Computer Science   *May 2024*
- Head Teaching Assistant: Introduction to Algorithms by Dr. Gagan Garg
- Courses: Computer Vision, Deep Learning (DL), Augmented Reality, Natural Language Processing (NLP), Software System Design

University Of Mumbai | Bachelor of Technology in Computer Engineering   *July 2022*

PROJECTS AND PUBLICATIONS

LLM Prompt Recovery |Python, PyTorch, Llama | [Github]
- Identified original prompts from large language model outputs on a custom dataset, achieving a Rouge Score of **65%**.
- Implemented PEFT, ReFT, and QLoRA architectures, significantly improving prompt recovery accuracy.

LifeSavAR: An AR First Aid Guide | Unity, C#, Mixed Reality Toolkit (MRTK) | [GitHub]
- Developed an AR application for emergency medical guidance with a focus on software development and automated testing for real-time assistance.
- Integrated Vuforia and MRTK to overlay visuals on a torso phantom, enhancing usability for non-medical users.

Predicting Ejection Fraction using Segmentation guided Vision Transformers | Python, PyTorch, Computer Vision | [Poster]
- Transitioned EchoNet-Dynamic to include transformer-based segmentation models, emphasizing software testing for accurate cardiac function prediction.
- Achieved a mean absolute error of **5.81** in Ejection Fraction prediction and an AUC score of **91%**.

"Injury Localization and Anatomical Segmentation in Ultrasound Spinal Cord Images," [ArXiv]
- Presented a spinal cord ultrasound dataset of **10,223** DICOM images, benchmarking state-of-the-art models for injury localization and anatomical segmentation.
- Achieved **99.5%** accuracy in injury detection with YOLOv8 and **84.66%** Dice score in spinal cord segmentation, demonstrating strong zero-shot generalization for clinical use.

"Mime3D - A Patient Monitoring System," ACCAI 2022 [Published in IEEE Xplore]
- Engineered a system using IMU sensors and ESP32S NodeMCU to transmit motion data via Arduino to a server, visualized in real time through a 3D human model in Unity.
- Successfully emulated limb movements of Bhabha Atomic Research Center volunteers during sports activities.

AWARDS

Joel Dean Excellence in Teaching Award | Johns Hopkins University   *April 2024*
Best Project Award – LLM Prompt Recovery | NLP Self Supervised Models   *May 2024*