Sahil Khose

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RESEARCH INTERESTS

Computer Vision, Continual Learning, Zero-Shot Learning, Semi/Self-supervised Learning and NLP.
Solving deep learning problems using a limited (ideally zero) amount of data is what piques my interest.

EDUCATION

Georgia Institute of Technology, Atlanta, USA Fall 2022
MS in Computer Science

Manipal Institute of Technology, Manipal, India 2018 – 2022
B.Tech in Computer and Communication Engineering (Big Data Minor GPA: 10.0) *CGPA: 8.56/10*

EXPERIENCE

Indian Institute of Science, Bangalore, India Jul 2021 – Jul 2022
AI Research Assistant *Advisors – Dr. Suresh Sundaram & Dr. Chandan Gautam*

- Innovating solutions for various problems in the **Continual Generalized Zero-Shot Learning (CGZSL)** setting at the **Artificial Intelligence and Robotics Lab.**
- Working on Sketch Based Image Retrieval, Domain Generalization and Object Detection in a CGZSL setup.

Manipal Institute of Technology, Manipal, India Apr 2021 – Jul 2022
Medical AI Research Assistant *Advisor – Dr. Harish Kumar JR*

- Developed a medical diagnosis system for **fovea segmentation** using semi-supervised segmentation.
- Worked on **macular degeneration classification** with interpretability for ophthalmology diagnosis.
- Working on **45 disease multi-label classification** using fundus images with the aid of SSL pre-training.

Project MANAS – AI Robotics Research Team, MIT, Manipal, India Feb 2019 – May 2021
AI Perception Developer

- Built a UGV robot for the **27th Intelligent Ground Vehicle Competition** held in Michigan, USA.
- Worked on developing a **level 2-3 autonomy** car on Indian roads for the **Mahindra $1Million Challenge.**

ACHIEVEMENTS

- **Project MANAS** stood **World Rank 1** at the **27th Intelligent Ground Vehicle Competition** (IGVC 2019).
- **IGVC 2019 Awards:** Grand Award - 1st (Lescoe Cup), Interoperability - 1st, Design - 2nd, Cybersecurity - 3rd.
- **Project MANAS** won the the **Mahindra $1Million Challenge (top 13 out of 153 teams in India)**.
- Top performer on Task 1 & 6 with special recognition on multi-task performance at SMM4H, **NAACL 2021**.

PUBLICATIONS

An Efficient Modern Baseline for FloodNet VQA
*[Best Paper Award] New in ML at **ICML 2022** GitHub | Paper* May 2022

- Authors: *Aditya Kane,* ***Sahil Khose***
- We design a simple and efficient VQA system on the FloodNet dataset achieving state-of-the-art performance.
- We revisit fundamental combination methods for VQA with modern image and text feature abstraction models.
- This simplified system requires significantly less training and inference time than modern VQA architectures.

Transformer based ensemble for emotion detection
*[Paper] WASSA at **ACL 2022** GitHub | Paper (aclanthology)* Mar 2022

- Authors: *Aditya Kane, Shantanu Patankar,* ***Sahil Khose****, Neeraja Kirtane*
- Additional Links: *Experiments* | *Slides* | *Poster* | *Video*
- Developed ensemble based solution consisting of multiple *ELECTRA* and *BERT* models.
- Proposed methods for *synthetically generating datasets* to mitigate class imbalance.
- Studied the behaviour of our models on various raw and synthetically generated datasets.

AMD Classification and Fovea Segmentation using Semi-Supervised Learning

Under Review Oct 2021

- Authors: ***Sahil Khose**, Ankita Ghosh, Harish Kumar J. R.*
- Faculty Advisor: *Dr. Harish Kumar J. R.*
- Developed a semi-supervised segmentation pipeline to train on **484** images for fovea segmentation.
- Designed a interpretable classification system on a dataset of **627** datapoints. The task being age-related macular degeneration with an imbalance of **1:5:5**. We use **Score-CAM, SS-CAM, and IS-CAM** to visualize the activation maps.

A Studious Approach to Semi-Supervised Learning

*[Poster] ICBINB at **NeurIPS 2021** GitHub | Paper* Sep 2021

- Authors: ***Sahil Khose**, Shruti Jain, V Manushree*
- Additional Links: *Poster*
- Performed **distillation** for **semi-supervised learning** producing better and smaller models with lesser labels for real-time deployment. Decreased both **size and inference time** without hurting the performance.
- We experimented on: EfficientNet-b5, ResNet18, and MobileNet-V3-Large to demonstrate the benefit of **model compression** on **four label splits**, highlighting the semi-supervised advantage and model optimization.

Extraction of Color Information from Images for Generation of Colored Outlines and Sketches

*[Paper] ML for Creativity and Design at **NeurIPS 2021** GitHub | Paper* Aug 2021

- Accepted: ***1.** [Paper] ML for Creativity and Design, **2.** [Poster] Deep Generative Models and Downstream Applications, **3.** [Paper] CtrlGen: Controllable Generative Modeling in Language and Vision, **4.** [Oral] New in ML workshop at **NeurIPS 2021**.*
- Authors: *V Manushree, Sameer Saxena, Parna Chowdhury, Manisimha Varma, Harsh Rathod, Ankita Ghosh, **Sahil Khose***
- Additional Links: *Demo | Poster | Slides*
- Applied image processing techniques and **unsupervised learning** to quantize and extract colors in images and render sketches with colored outlines.
- Used **conditional GANs** for image to colored-sketch generation with the help of colorspace manipulation.

Semi-Supervised Classification and Segmentation on High Resolution Aerial Images

*[Spotlight] Tackling Climate Change with ML at **NeurIPS 2021** GitHub |Paper* May 2021

- Authors: ***Sahil Khose**, Abhiraj Tiwari, Ankita Ghosh*
- Additional Links: *Demo | Blog | YouTube | Video*
- Handled a dataset of 1450 images with just **25% labelled** data and a **class imbalance of 1:6.**
- ResNet18 with our implemented semi-supervised pipeline fetched **96.70% test** accuracy beating the best model of the **FloodNet paper** by a **huge 3% margin** with **less than half** the parameters.
- Implemented a **semi-supervised multi-class segmentation** pipeline for 10 class segmentation. DeepLabv3+ with EfficientNet-B3 backbone fetched us 52.23% mIoU on the test set.
- Analytically and visually analyzed our performance for segmentation on multiple architectures like **UNet, PSPNet, DeepLabV3+** with and without **pseudo label** based semi-supervised learning.

BERT based Transformers lead the way in Extraction of Health Information from Social Media

*[Paper] Published in proceedings of **NAACL 2021** at SMM4H workshop GitHub | Paper (aclanthology)* Apr 2021

- Authors: *S Ramesh, **Sahil Khose**, Abhiraj Tiwari, Parthivi Choubey, Saisha Kashyap, Kumud Lakara, N Singh, Ujjwal Verma*
- Faculty Advisor: *Dr. Ujjwal Verma*
- Additional Links: *Poster | Slides*
- **ADE classification**: Handled a **1:13 class imbalance** dataset. Trained *RoBERTa* and *BioBERT*. Achieved valid F1: 85% test F1: 61%. *(ADE: Adverse Drug Effects)* **[Rank: 1]**
- **ADE span detection**: *RoBERTa* based NER pipeline. Achieved valid F1: 54% test F1: 50%.**[Rank: 2]**
- **COVID classification**: *RoBERTa, DeBERTa, Covid-Twitter BERT, BERTweet, and ensemble* were trained for the 3 class classification problem. Achieved valid F1: 99% test F1: 94%. **[Rank: 2]**

Projects

Self-Driving Car and AGV – Project MANAS *GitLab* | *Website* Feb 2019 – May 2021

- Successfully implemented **Lane Detection, Speed Bump Detection, Driving Imitation System, Depth Map Generation** using multiple cameras and LiDAR input using Deep Learning.

StackGAN for text to image generation *GitHub* Oct 2020

- Implemented the **StackGAN** (2 stages GAN) architecture from scratch in PyTorch with enhanced BERT data representations for synthesizing photo-realistic bird images from their textual descriptions.

QANet for SQuAD 2.0 (Question-Answering) *GitHub* Sep 2020

- Implemented the **QANet** architecture from scratch in PyTorch consisting exclusively of convolution and self-attention, achieving **13x** faster train & **9x** faster inference than the BIDAF model (previous SOTA).

Stock Prediction using Hyper Graphs *GitHub* Aug 2020

- Developed a Hypergraph structured dataset and built a Hypergraph NN based architecture with **Hypergraph CNN, BERT, LSTM and attention network** for stock prediction of 500 stocks over time.

Neural Machine Translation *GitHub* | *Demo* Jul 2020

- Built a Neural Machine Translation model using a seq2seq bi-LSTM architecture with attention and hybrid character-word level language modelling. Achieved **37 BLEU** on Spanish-English translation.

Technical Skills

Languages: Python, C++, Java, C
Tools and Libraries: PyTorch, NumPy, Tensorflow, OpenCV, Matplotlib

Extracurricular

FruitPunch AI – AI expertise head Aug 2021 – Present

*Established the first international chapter of FruitPunch AI, a non profit organization **headquartered in Europe**. Currently engaged in building the community and promoting AI for social good initiatives*

YouTube Channel – Online Educator Jun 2021 – Present

*Conducts **presentations and explanations** on cutting edge research papers in the field of AI.*

NAACL reviewer Mar 2021

Reviewed multiple research papers as a part of the review committee for SMM4H Workshop.

Research Society Manipal – AI division mentor Nov 2020 – Present

***Mentoring** and **guiding** several students to pursue research in the field of Deep Learning.*

Medium | WordPress | Website Feed Oct 2018 – Present

*Documented my BTech college journey with a series of tech and non-tech **blog posts**.*