

# Niraj Mahajan

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## EDUCATION

### UC San Diego

Master of Science in Computer Science

- Courses: Deep Generative Models, Computer Vision, Design and Analysis of Algorithms

La Jolla, CA

Sept 2022 – June 2024

*Expected completion by Fall 2022*

### Indian Institute of Technology Bombay | GPA: 9.33

Bachelor of Technology with Honors, Major: Computer Science and Engineering

- Activities: Teaching Assistant (Computer Vision: Theory and Lab, Digital Image Processing), CSEA General Secretary

- Courses: Medical Vision, Computer Vision, Reinforcement Learning, Image Processing, Fairness in ML, AI, ML with Graphs

Mumbai, India

Jul 2018 – May 2022

## EXPERIENCE

### University of Illinois Urbana-Champaign

Research Intern

- Replicate the FC computation using gaussian clustering on the convolutional outputs to enhance their explainability
- Developed a novel algorithm based on shifting and shrinking class clusters as trainable parameters in the convolutional space

Illinois, USA

July 2020 – April 2021

### UNSW, Canberra

Research Intern

- Employed ResNet in a siamese network for predicting the 3D registration parameters on synthetically generated femur images
- Incorporated a half dark channel filter algorithm to trim the soft tissue pixels from the clinical knee CT images

Canberra, Australia

April 2020 – July 2020

## RESEARCH PROJECTS

### Weak Supervision for Medical Abnormality Classification

- Achieved state-of-the-art segmentation on the BUSI dataset by using Pyramid Scene Parsing and Efficient Spatial Pyramid Blocks
- Developed an end-to-end classifier-segmenter pipeline to classify BUSI images using weak supervision for training the segmenter

IIT Bombay

### Recurrent Neural Networks for Analysing 3D Medical Data

- Formulated 3D MRI images as a time series and tried several time series methods to tackle medical vision problems
- Devised a method to induce artifacts in MRI images by distorting the Fourier domain pixels to simulate patient movement

IIT Bombay

### Conditional Diabetic Retinopathy Image Synthesis

- Incorporated a Pix2Pix Network, conditioned over the DR grade to generate grade-controlled abnormality images
- Optimised the process with a two-stage pipeline by generating the blood vessel structure followed by populating the fundus pixels

IIT Bombay

### Location Controlled Brain Tumour Image Synthesis

- Devised a pipeline for generating location-controlled abnormality in 2D brain MRI images using Controllable GANs
- Designed a rectifier model based on a Context Encoder with a Pix2Pix backbone to generate corresponding healthy images

IIT Bombay

### Matched Filtering Based Convolutional Blocks

- Computed classwise representative filters from the activations of different regions of input images as perceived by the conv layers
- Visualised the features extracted by these filters based on their convolutional output at various spatial locations

University of Illinois at Urbana-Champaign

## KEY TECHNICAL PROJECTS

### Deep Retinex Decomposition for Low-Light Enhancement

- Implemented a neural network pipeline for separating and enhancing the reflectance and the illumination components of images

Fall 2021

### Domain Adaptable Feature Learning for Localisation

- Visualised the features learned by the convolutional layers using Class Activation Mappings and Saliency Maps
- Performed Weakly Supervised object localisation for digit detection with a classifier trained to discriminate CIFAR10 from SVHN

Fall 2021

### Fischer Faces for Facial Recognition

- Highlighted the performance of Fischer's LDA for face recognition in varying lighting & intra-class variance conditions

Fall 2020

### Popular Link Prediction Algorithms for Social Networks

- Surveyed heuristic-based algorithms like Adamic Adar, Katz Measure, Preferential Attachment on link prediction applications

Fall 2020

### Face Ageing using GANs

- Designed and trained a cGAN to induce two-way facial age transformation on images using an AlexNet-based age classifier

Spring 2020

## SKILLS

### Languages

(Fluent) Python, Git, Matlab, (Familiar) C++, SQL, Bash, Java, C, HTML/CSS, JavaScript, Make, CMake

### Libraries

PyTorch, OpenCV, Scipy, NumPy, Pandas, Matplotlib, Keras, TensorFlow