# Kishan Sharma

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## Education

**M.Sc in Computational Science and Engineering** *Munich, Germany*

TECHNICAL UNIVERSITY OF MUINCH (TUM), GERMANY *Oct. 2016 - Exp. Mar. 2019*

Cumulative Grade : 1.7

**Bachelor of Technology in Mechanical Engineering** *Jodhpur, India*

INDIAN INSTITUTE OF TECHNOLOGY JODHPUR (IIT), RAJASTHAN *July. 2011 - Apr.2015*

Cumulative Grade : 2.0

## Work Experience

**Dynamic Vision & Learning Group, TU Munich** *Munich, Germany*

STUDENT ASSISTANT, SUPERVISOR: PROF. LAURA LEAL-TAIXE, DR. JAN DIRK WEGNER (ETH ZURICH) *Dec. 2018 - Mar. 2019*

- Applied methods developed during master thesis on Breast Cancer Dataset to predict count and size histogram of malignant cancer cells
- Fine-tuned our model using object count and size histogram as intermediated results and improved cellularity score prediction
- Submitted a research paper, "HistoNet-Predicting size histograms of object instances" in International Conference on Computer Vision 2019

**PreciBake GmbH** *Munich, Germany*

WORKING STUDENT AT ARTIFICIAL INTELLIGENCE DEPARTMENT *Aug. 2017 - May. 2018*

- Modeled and trained Deep Learning architecture for predicting tray motion, tray level and for classifying product from outside and inside of the oven for automatic baking program selection
- Implemented UNet architecture to extract tray regions from video; Performed object detection to count and track buns moving on conveyor belt using semantic segmentation (SegNet)
- Exploited temporal patterns with Deep Recurrent Neural Networks (GRU) for the estimation of thickness of the product, baking time estimation and product recognition using input video data and sensor data as in intermediate input; Compared the result with Multiple input static CNN
- Collected cleaned and pre processed various type of data (i.e videos , images, time series sensor data); Analysed sensitivity of multiple sensor data on the performance of model prediction to reduce the product cost

## Projects

**Master Thesis: Image-based population & Size estimation of Fly Larvae** *ETH Zurich, Switzerland*

SUPERVISOR : PROF. DR LAURA LEAL-TAIXE (TUM), DR. JAN DIRK WEGNER (ETH ZURICH) *Jun. 2018 - Nov. 2018*

- This thesis aims to develop complete solution of automation of most laborious part of Bio-waste conversion by counting and estimating size of insect larvae
- Collected and prepared image dataset of fly larvae which consists of 11,000 pixel wise labeled instances, representing crowded scenarios
- Built a novel deep learning architecture (HistoNet), which counts and predicts the size distribution of objects directly from an input image, used deep supervision at hidden layers to further improve our method, showing superior results with respect to state-of-the-art instance based segmentation methods while having 85% less parameters
- Validated robustness of the developed method by preparing synthetic data of various sized thin ellipses following different object size distribution. Built GUI for user friendly usage of developed method

**PRAKTIKUM : Machine Learning For Medical Imaging**

DETECTION AND TRACKING OF SURGICAL EQUIPMENTS *Oct. 2017 - Feb. 2018*

- Prepared and preprocessed dataset using Robotic Laparoscopy surgical equipment videos from Endovis Challenge Dataset and created labels as gaussian probability maps of their joint locations
- Implemented UNet architecture to classify and localize joint locations of equipment; Trained Network using various training schedules for multiple objective learning; achieved state of the art accuracy for pose estimation of some equipments
- Modeled FCN using VGG and ResNet architecture, Compared the results of FCN and UNet based approaches

**SEMINAR : Deep Generative Models**

AUTOENCODING BEYOND PIXELS USING LEARNED SIMILARITY METRIC

- Submitted a comprehensive report by Analysing , implementing and constructively criticizing the proposed methodology in the paper
- Presented the paper explaining the proposed technique and fundamentals of Autoencoder, VAE, GAN and compared the results

**Binary Segmentation -Gaussian Mixture Model Estimation**

- Modeled densities of fore & background pixels based on their intensity by estimating 2 mixture of gaussians each of 5 components
- Learned fg & bg densities distribution using EM algorithm and applied them to input image and segmented fg & bg regions in C++ using OpenCV

### Object Pose Estimation Model Based Tracking

- The aim of the project was to track a texture-rich 3D object in a series of images using camera pose estimation and projection of the 3D object on the images in every input image
- Associated the texture information with the 3D model using SIFT features in MATLAB. Estimated pose using PnP and implemented RANSAC and refined the pose using non linear optimization Levenberg Mardquardt algorithm
- Performed tracking of the camera in respect to given 3D model for given sequence of test images

### Random Forest: Object Classification & Detection

- Extracted HOG descriptors of images using OpenCV library for training Random Forest to classify images in 6 classes in C++
- Generated bounding boxes and used sliding window to classify contents within each bounding box, filtered out bounding boxes with low confidence using non maximal suppression
- Evaluated detection result by using metric used in pascal visual object challenge metric and plotted PR curve

### CNN: Object Classification & Pose Estimation

- The aim of the project was to do pose estimation and object instance recognition of already-detected objects simultaneously by learning an appropriate discriminative feature space using CNN
- Implemented a batch generator forming triplet batches consisting of real images and synthetic rendered sample, using the quaternion similarity
- Constructed CNN closely following the LeNet architecture, implemented loss function as addition of triplet and pairs loss and trained network using Adam optimizer in Tensorflow
- Implemented KNN search in descriptor space of training images to evaluate the network on test images, visualized feature descriptors in 3D space and plotted confusion matrix

### Mining Massive Yelp Dataset

- **Restaurant Recommendation:** Detected and removed Duplicate reviews using Locality Sensitive Hashing with Cosine Similarity and prepro-cessed dataset; Performed latent factor matrix factorisation using Alternating Optimisation and Gradient Descent for the recommendation of restaurant and compared their results.
- **Restaurant Review Classification:** Used HMM as a probabilistic generative model for text data; Trained two HMM for classifying a review into 1-star or 5-star using Baum-welch algorithm
- **Restaurant Ranking:** Performed topic specific page rank on a directed weighted graph of restaurants; calculated standard page rank scores
- **Clustering Users:** Performed spectral clustering on an undirected weighted graph of users based on reviews; Qualitatively evaluated results using ratio cut and normalized cut

### Image based Plant Disease Detection using Deep Learning

- The aim of the project was to correctly classify the plant type and the disease given an image of a plant leaf in 38 plant-disease classes
- Modified Network architecture and used transfer learning to train ResNet-18, DenseNet, AlexNet & VGG-Net and compared their results, Achieved state of the art accuracies for DenseNet in test results

### Case Study-Bundesliga League Game Outcome Prediction

- Extracted expressive features such as Total goal score, current trend, goal scored and conceded etc. using past 5 Bundesliga season data
- Approach I -Implemented Logistic multinomial regression using R library GlMNET to predict the outcome and final team ranking
- Approach II - Modeled input features by using Poisson regression to predict goal scored by home and away teams and thus inferred the outcome

### Generating 2D Velocity Fields using GAN

- Generated velocity fields of simple 2D plume fluid simulation using mantaflow (http://mantaflow.com/) software
- Modeled a simple Generative Adversarial Network (GAN) and generated 2d velocity fields, Modified the generator architecture to address the checkerboard problem, compared the results with including divergence-free condition

### Semantic Segmentation using Transfer learning

- Performed semantic segmentation by doing transfer learning using Resnet18 pretrained ConvNet on PASCAL semantic part dataset
- Trained the model by fine tuning last layers while keeping early layers fixed, Used CUDA libraries in PyTorch to decrease the training time

## Technical Skills

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| PROGRAMMING LANGUAGE | CPP ★★★★☆ Python ★★★★★ Matlab ★★★★☆ R ★★★★★ |
| DEEP LEARNING FRAMEWORK | PyTorch ★★★★★ TensorFlow ★★★★☆ Theano ★★★★☆ |
| IT-KNOWLEDGE | MS Office ★★★★☆ Latex ★★★★☆ Windows ★★★★★ Linux ★★★★★ |

## Achievements

- Awarded Erasmus Scholarship for Swiss-European Mobility Student Exchange Program at ETH Zurich
- Won 2nd Prize at Microsoft Student AI Lab Competition by building Emotional trainer bot for Asperger syndrome patients
- Stood among top 1% in Joint Entrance Examination out of more than 0.4 million students
- Awarded Merit Cum Means Scholarship from Indian Institute of Technology Jodhpur for 2 Years
- Integral Part of Dance club, IIT Jodhpur for 4 years, mentored the club for 2 years

**Munich, 27th May 2019**