Ifty Mohammad Rezwan

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Summary of Skills

- Around three years of research experience in the area of Machine Learning and Deep Learning
- Around two years of professional software and hardware based product development and deployment
- Has expertise and excellent understanding in a variety of subsets in the field of computer vision, natural language processing and tabular data
- Has deployed efficient machine-learning and deep-learning based solutions and products through the use of APIs, on-device solutions and cloud-based instances
- Has good command over multiple computer languages and technologies
- Has credible experience at generating robust data in multiple scenarios where no data or a few datapoints were present and data was crucial to the solution
- Has written and published a paper at a peer-reviewed conference with more to come
- Has excellent command over English for reading and communication
- Flexible to dissecting, understanding, improving or migrating old codebases
- Flexible to learning and teaching others new technologies
- Strong enthusiasm to reading, dissecting and implementing new research papers especially in the field of machine learning and deep learning
- Trying to create and open-source a number of datasets and create a few practical solutions with a number of peers where data is scant yet vital to the problem being addressed

Education

- **North South University** Dhaka, Bangladesh
  Bachelor of Computer Science & Engineering *September 2014 - March 2020*
  Specialization Courses: *Computer Vision, Natural Language Processing, Pattern Recognition*

Research Interests

- **Computer Vision**: Convolutional Capsule Networks, Object Tracking, Person Re-identification, Any Shot Object Detection and Tagging, Weakly Supervised Semantic Segmentation, Uncertainty Based Deep Learning, Edge Device Based Machine Learning, Medical Imaging
- **Natural Language Processing**: Resource Constrained Language Models, Word Embeddings, Commonsense Reasoning
- **Multimodal Problems**: Optical Character Recognition, Complex Scene Text Recognition, Visual Question & Answering
- **Robotics**: GPS-Denied Navigational Path Planning, Robot Swarm

Professional Experience

University/Organisation	Position	Dates
Nybbles System LTD.	Jr. Machine Learning Engineer	July 2021 - Present
North South University	Research Student	Feb 2021 - June 2021
Apurba-NSU Research Lab	Graduate Resesarch Assistant	July 2020 - December 2020
North South University	Research Assistant	Jan 2019 - Jan 2020
Self-Employed	Various Positions	March 2019 - Present

Publications

- **MixCaps: Capsules With Iteration Free Routing (Accepted, DICTA2020)**: We proposed an iteration free routing algorithm with extendable mixed capsules. This brought about better hierarchical feature representations while being memory efficient. They performed better on complex datasets such as Cifar-10 and Cifar-100 than previous cnn and capsule based architectures. *Technology*: Python, Pytorch, Matplotlib, & OpenCV (September '20)
- **A Systematic Approach Towards Bangla Optical Character Recognition Leveraging Synthetically Generated Data(Under Review, IEEE ACCESS)**: Optical Character Recognition (OCR) has been a longstanding domain of research in the field of Computer Vision. The prevalence of neural networks has led to the attainment of remarkable performance for OCR. However, OCR in Bangla have had minimal advancement predominantly due to the dearth of data organized particularly for the text recognition problem. In this paper, we present a synthetically generated corpus for Bangla OCR containing 2 million samples that is representative and sufficiently varied in terms of fonts, domain and vocabulary size. We use this synthetic dataset to train a Bangla OCR model based on the popular CRNN architecture and propose three character representation strategies to design the final labels of the model. To evaluate the trained model, we also present six different test sets each serving a specific purpose including data containing real, non-synthetic samples. We conduct the experiments

using VGG and ResNet feature extractor using three character representation methods and report six results for each test set as the baseline. To further evaluate the effectiveness and the generalizability of the synthetic data, we perform an additional evaluation on an external dataset ranging over multiple categories, fitting for a production scenario. The best results of this paper indicate a Character Recognition Rate (CRR) of 96.26% and a Word Recognition Rate (WRR) of 83.84% on one of our most diverse real test sets which establishes a reliable baseline for Bangla Word Level OCR.ound a minimum edit distance of 0.9477 with synthetic data only. *Technology*: Python, C++, Pytorch, & OpenCV (Nov '21)

- **NimbleNav: An automated Global Mapping System for GPS-Denied Navigation Stacks(Rejected, SRSS2020)**: An automated Global mapping system that provides a global map to robots from aerial images within a very short time. Normal approaches require the agents to traverse the unexplored terrain and provide a map which can culminate to loss of time and agents. We provide two mapping based solutions, one including basic threshold based image processing and a deep learning based segmentation approach for more complicated region. We test our hypothesis in a simulation based environment. *Technology*: Python, C++, ROS, Webots, Gazebo Matplotlib, OpenCV & Multi Robot Protocols (July '20)

Professional Experience

- **Nybbles System LTD.** Under ML Team
  Jr. Machine Learning Engineer
  - **Drowsiness Detection**: Drowsiness detection through eye blink detection on edge based devices for transport personal
  - **Fallout Panic Button**: Smartphone based real-time action detection. Oversaw and participated in creating the total pipeline which involved data gathering, synthetic data generation and heuristic rule and machine learning based model generation. Deployed the model on smartphones and edge devices.
  - **NybFace**: Edge device based Face Detection and Recognition API. Performed maintenance and migration to edge-based devices. Added modules for Masked Face Detection and Recognition.
  - **Survello**: Multi purpose, multi module based surveillance solution. Performed maintenance. Also converted components and models for efficiency. Added person re-identification and face mask presence detection to existing modules.
  - **Canal Monitoring**: Real time canal monitoring solution to detect people causing litter. Also added face detection and recognition to further re-identify and verify the people involved.

- **North South University** Under Dr. Shafin Rahman
  Research Student
  - **Object Tagging & Detection**: Few, Zero and Any Shot Object Detection and Tagging grounded in Deep Learning

- **Apurba-NSU Research Lab** Under Apurba Technologies & Dr. Nabeel
  Machine Learning Research Engineer
  - **Problem Description**: Develop a real time text recognition based solution for diverse sets of government documents under EBLICT without any predefined real world data.
  - **Synthetic Data Generator**: Developed an end to end synthetic data generating pipeline which takes in a list of words, fonts and size as prerequisite.
  - **Data Collection**: For the synthetic data generation pipeline, we collected a number of fonts which best represent our problem domain. To address the rich representation on the variation of words in the synthetic dataset we collected a few corpuses and articles from various subject domains, cleaned them and created a unique list of words.
  - **Noise Mapping Schemes**: As synthetic data is not enough to model real world noise, we explored numerous noise modelling schemes ranging from hand-crafted distribution based noise cocktails to generative adversarial network based noising solutions.
  - **Novel Bangla Character-Level Tokenizer & Model Fitting**: We introduced a new rule-based Bangla character-level tokenizer which outperforms all other previous Bangla character-level tokenizers. We explored various convolutional recurrent and transformer based models for the best fit of our data.
  - **Real World Evaluation**: Created and annotated a test set with five different protocols to test real world deployment and performance. This test set with their protocols had their own diverse set of noises ranging from old documents to recent documents.
  - **Model API & Flagger Models**: We created a REST Based API and deployed our model to production. Due to the necessity of sending various incoming images to various models after segmentation, multiple rapid flagger based classfication models were required. We created a real time mobilenet based classifer pipeline to address this issue of multiple flaggers. We used our synthetic data generator pipeline to create datasets for these flaggers which were supplemented by our noise schemes to reflect real world images.
  - **Supervision**: Our work and methodology was verified by consultants from EBLICT, BUET and IIT,Dhaka University

- **North South University** Under Dr. Nabeel
  Research Assistant
  - **Computer Vision**: Developed a novel classification algorithm and optimized variants of others
  - **Object Detection**: Developed an optimized edge based object detection algorithm and deployed it on a few IOT devices

- **Self-Employed** Under Various Teams
  Software and Hardware based Solutions, Consultancy
  - **Product Deployment**: Created and successfully deployed a few software and hardware based solutions for a number of clients ranging from established companies to defense based institutions
  - **Consultancy**: Worked extensively with various teams working on machine learning based solutions. These solutions range from data science based solutions to deep learning based products.

Projects & Abstracts

- **IntelTrack: A real-time tracker for mouse based experiments(Computer Vision, Edge Computing, Visualization)**: (Work in progress) A mouse tracker that works at real-time of around 20 frames per second on an average CPU that tracks the mouse and provides relevant graphical results for pharmaceutical experiments without any special library. *Technology*: Python, C++, Darknet, OpenCV, Matplotlib, Seaborn & Pandas (Jan '19)
- **Embedding Visualizers (Language Models, Word Embeddings, Visualization)**: A Library that takes in tokens from Language models and visualizes the embedding vector of all words on a graph. Provides insights into the nature of knowledge from language models and word relations. *Technology*: Python, JavaScript, Bokeh, TensorFlow & PyTorch. (March '19)
- **Emotion Detection with various popular image classification architectures (Image Classification, Visualization)**: Tested Imagenet winning architectures on the FER13 dataset.Provided insights into the confidence interval of various architectures on random images to see which architecture is better and why. *Technology*: Matplotlib, PyTorch, Python & OpenCV (March '19)
- **Zero-shot Image Tagging with Language Prior (Image Tagging, Zero-Shot Learning)**: Image Tagging has multitudes of classes. To train multitudes of classes in a supervised manner, one requires images for all classes which might not always be available. In such cases, we introduce the use of language and other object relation based language prior which helps classify tags for images which may not be present in the training dataset. *Technology*: PyTorch, Python & OpenCV (June '21)
- **Robust Eye Blink Detection based on novel area ratio formulation (Ongoing, Image Classification, Face Detection)**: Created and tested a novel iris to eye area ratio based eye blink detector which is invariant to user's face distance. *Technology*: Tensorflow, Mediapipe, Gstreamer, C++, Python & OpenCV (October '21)
- **Structurally Aware Meta Face Spoofing (Ongoing, Face Detection, Face recognition)**: Most spoof detection systems today fail when it comes to under-represented people mostly due to dataset bias. We try to propose a system which is more structurally aware rather than semantically aware when it comes to spoof detection thereby eliminating the texture bias introduced by popular spoof detection datasets *Technology*: PyTorch, Python & OpenCV (November '21)
- **Holistic Face Detection and Verification System(Computer Vision, Edge Computing, Visualization)**: (Work in progress) A pipeline that takes in an image. Crops out the bounding boxes and labels the presence of masks. The cropped faces are then converted into embedding through a domain adapted backbone. The cropped faces are then verified through the calculation of distance between cropped face and source embedding. *Technology*: Python, C++, Darknet, Pytorch, Onnx OpenCV, Matplotlib & Seaborn (November '21)

Technical Skills Summary

- **Languages**: Python, C, C++, JavaScript, Bash, Java, R
- **ML Frameworks**: Scikit-Learn, Pytorch, TensorFlow, Keras, MxNet, Darknet, PaddlePaddle, Scipy
- **Data Science Libraries**: Pandas, Numpy, Caret, MLr, Dplyr
- **Visualization Libraries**: Matplotlib, Plotly, Seaborn, D3, Bokeh, Ggplot
- **Image Processing**: OpenCV, ImageIO, Pillow
- **Version Control**: Git
- **Database Tools**: MySQL
- **Web Development Tools**: HTML, CSS, React, Flask, FastAPI
- **Robotic Libraries**: Robotic Operating System(ROS), Webots

Extra-Curricular Activities

- **IELTS English Academic Based Test, (Band Score: 8.0)**:
  - Reference: A3-BD001-S-6327781
  - Reading Band : 8.5
  - Listening Band : 8.5
  - Speaking Band : 7.5
  - Writing Band : 6.5
  - Participating Date : September, 2021
- **Competitive Machine Learning**:
  - TIC-HEAP Cirta Particle Classification Challenge: 11th out of 163 participants
  - ICLR Workshop Challenge #1: CGIAR Computer Vision for Crop Disease: 33rd out of 822 participants
  - SARAS endoscopic vision challenge for surgeon action detection: 66th out of 75 particiapants
  - object-CXR:Automatic detection of foreign objects on chest X-rays: 33rd out of 57 participants
- **Self-Teaching**: At present I am trying to teach myself:
  - Basic reinforcement learning
  - DevOps based technologies
  - To build business intelligence and machine learning based solutions geared towards real life clients.

References

- **Dr. Nabeel Mohammad** — Associate Professor
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