Research Experience & Publications

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1 Research Experience & Publications

In my final year of undergraduate studies, I collaborated with multiple professors. Along with Professor Dr. Al Mehedi Hasan and Dr. Jungpil Shin, I also worked with Professor Dr. Ali Hossain from the Department of Computer Science and Engineering at RUET. Here are the details of my publications in brief:

- **Lung opacity classification with convolutional neural networks using chest x-rays [ICECE 2020]** **[Link]**

  Authors: **Khan Fashee Monowar**, Md Al Mehedi Hasan, and Jungpil Shin

  Our Contributions:

  - Compared off-the-shelf CNN architecture's performance on the binary and multiclass dataset.
  - Implemented weighted binary cross-entropy loss function to reduce class imbalance.
  - Phase 1 evaluates how well CNN architectures differentiate the Lung Opacity class from No Lung Opacity + Normal.
  - Phase 2 evaluates how well CNN architectures differentiate the Lung Opacity class from only the normal class.
  - In both cases, Xception achieved the best AUC scores, with **91.0% in Phase 1 and 99.1% in Phase 2**, respectively.

  Short Abstract: Recently, deep learning achieves radiologist-level performance in chest X-ray interpretation. In our research, we trained and evaluated various deep convolutional neural networks (CNN) architectures to detect potential lung opacity from chest X-rays. We observed how strongly architectures could differentiate lung opacity from normal and other abnormal chest X-rays. In these circumstances, A CNN-based model (Xception) achieved 91.0% AUC along with 83.95% accuracy. Moreover, we also

observed models achieved a better performance on lung opacity vs normal chest X-ray classification (excluding abnormal class) where Xception achieved 99.1% AUC, 97.19% sensitivity, and 95.71%accuracy. Therefore, the purpose of this study is to investigate the classification ability of deep CNN architectures which helps to develop an automatic lung opacity detection system.

- **A Lightweight Convolutional Neural Network Model for Child Pneumonia Classification [ICICT4SD 2020]** [Link]

  Authors: **Khan Fashee Monowar**, Md Al Mehedi Hasan, and Jungpil Shin

  Our Contributions:

  - Designed a **lightweight, 6 layers** CNN architecture that has 6.8 million parameters.
  - Trained binary dataset (pneumonia and normal class) with the model from scratch.
  - Compared our model performance with another off-the-shelf CNN models and recent studies.
  - Achieved the best Accuracy, Precision, F1, Specificity, and AUC score among the studies we have mentioned.

  Short Abstract: Pneumonia is still a serious threat for children including newborns. In recent years, computer-aided detection systems (CAD) and medical image classification are progressively turning into another research territory. Currently, researchers build various models to detect pneumonia from chest X-rays. However, there is still a lack of computationally efficient models to diagnose pediatric pneumonia. Further, some off-the-shelf or pre-trained models are not always suitable for mobile and embedded vision applications since these models are not lightweight. In our research, we built a lightweight CNN model from scratch using basic building blocks which able to learn lung texture features and detect pediatric pneumonia. We compared our proposed model performance with some off-the-shelf models. Our proposed model achieved the best AUC (99.0%), test accuracy (94.6%), F1 (94.7%), precision (93.2%), and specificity (93.1%) scores. Moreover, we employed several data augmentation algorithms to increase the model's classification ability.

- **ECG Heartbeat Classification Using Ensemble of Efficient Machine Learning Approaches on Imbalanced Datasets [ICAICT 2020]** [Link]

Authors: Md Atik Ahamed, Kazi Amit Hasan, **Khan Fashee Monowar**, Nowfel Mashnoor, and Md Ali Hossain

Our Contributions:

- We compared some well-known machine learning approaches with other state-of-the-art related methodologies.
- Used two datasets, MIT-BIH Arrhythmia which contains five classes and PTB Diagnostic ECG which contains two classes.
- We also applied an ensemble approach (hard voting).
- For MIT-BIH, ANN with class weight approach gained the best accuracy (**98.06%**).
- For PTB Diagnostic ECG, Ensemble method achieved the best accuracy, recall, and precision (**97.66%, 96.90%, and 97.06% respectively.**)

Short Abstract: Being electrocardiogram already an established method for analyzing cardiac health, it gained many researchers' interests to classify heartbeats accurately. In this paper, some well-known machine learning approaches are used by tuning and compared with other state-of-the-art related methodologies. The datasets are used in this research work, are highly imbalanced and handled with penalizing the loss value of the Artificial Neural Network (ANN) by assigning class weights. Two different enriched ECG datasets are selected for this research. They are MIT-BIH Arrhythmia which contains five classes and PTB Diagnostic ECG which contains two classes. About **98.06% and 97.66%** accuracy are achieved with proposed approaches for MIT-BIH Arrhythmia and PTB Diagnostic ECG dataset respectively. Both cases this research outperforms all the other state-of-the-art methodologies.