|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sl. No | Citation | Methodology | Dataset | Result | Merits and Demerits |
| 1. | Detection of COVID-19 using CXR and CT images using Transfer Learning and Haralick features  **Varalakshmi Perumal**  **Vasumathi Narayanan**  **Sakthi Jaya Sundar Rajasekar** | In this paper, the transfer learning technique has been applied to clinical images of different types of pulmonary diseases, including COVID-19. It is found that COVID-19 is very much similar to pneumonia lung disease. Further findings are made to identify the type of pneumonia similar to COVID-19.  **The classification was performed between COVID-19 images, chest x-ray of pulmonary diseases and The data for the viral, bacterial pneumonia and normal images.**  CNN models like Resnet50, VGG16 and InceptionV3 are used.  Total of 5 pre-defined CNN models are used. All the 5 CNN models perform binary classification.  **Steps:**   1. Data augmentation of image by histogram equalization, weiner filter and image cropping 2. The Haralick features are extracted from images that are then resized. 3. Resnet50, VGG16 and InceptionV3 are used to find COVID-19 similar to pneumonia. 4. Covid-19 similar to viral pneumonia seperated from above dataset. 5. Transfer the knowledge gained by viral pneumonia to detect covid-19. Final classification used for detecting covid-19 from this dataset. | **Covid 19 Chest X-ray Dataset** (Source: [github,RSNA](https://github.com/ieee8023/covid-chestxray-dataset))   * X-ray: 205 * CT-scan: 202   **Chest X-ray Images**:  (Source: NIH)  The data for the Chest X-Ray pulmonary diseases are obtained from NIH with total of 81,176 observations with disease labels from 30,805 unique patients. The images are of size 1024x1024.  **Disease Image**  Atelectasis 11559 Cardiomegaly 2776 Consolidation 4667 Edema 2303  Effusion 13317 Emphysema 2516 Fibrosis 1686 Hernia 227 Infiltration 19894 Mass 5782 Nodule 6331 Pleural Thickening 3385 Pneumonia 1431 Pneumothorax 5302  Viral, bacterial pneumonia and normal images:  (Source: mendely)  The data for the viral, bacterial pneumonia and normal images are obtained from Mendeley with total of 5,232 images | The time taken for VGG16 is less because it is only 16 layers deep while resent50 and inceptionV3 are 50 and 48 layers deep respectively even with better accuracy compared with other models.  It is found that COVID-19 is as similar as viral pneumonia. The VGG16 model correctly identifies the COVID-19 data with 0.012 misclassification rate  We can find that out of 407 images for COVID-19 and normal images, 385 COVID-19 images are correctly classified as COVID-19 and 22 images are falsely classified under non viral pneumonia class.  **VGG16:**  **Accuracy1: 93.8%**  **Accuracy2: 91.4%**  **Elapse time: 39min**  **Loss: 0.1272**  **Resnet50:**  **Accuracy1: 89.21%**  **Accuracy2: 87.92%**  **Elapse time: 57min**  **Loss: 0.2433**  **InceptionV3:**  **Accuracy1: 82.42%**  **Accuracy2: 78.15%**  **Elapse time: 79min**  **Loss: 0.3989**  We can find that the pre-trained VGG16 model has correctly classified the CT scan image of chest as COVID-19 | **Merits:**   * The efficacy of the proposed model is compared with other recent studies on COVID-19 conventional classification works and it is given in Table. From this performance analysis, the proposed transfer learning model outperforms the other existing models.   **Demerits:**   * Since the dataset is taken from different websites the image quality was different. |