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DESIGN AND DEVELOPE DEEP MODELS TO INVESTIGATE COVID-19 USING DEEP LEARNING LUS IMAGES

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Abstract:

In medical imaging deep learning has successfully proved in the wake of the recent COVID19 pandemic situation, some works have started to investigate DL based solutions for the assisted diagnosis of lung diseases. In this project previous works focus on CT scans reports, this paper studies the application of DL techniques for the analysis of lung ultrasonography (LUS) images. we present a dataset of LUS images collected from several Italian hospitals, with labels indicating the degree of disease severity at a frame-level, video level, and pixel-level.by checking these data, introduce many deep models that address relevant tasks to analyse the LUS images automatically.

I. INTRODUCTION

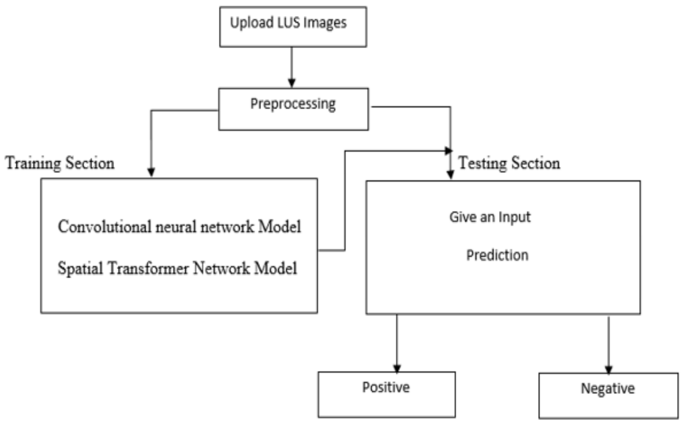
covid-19 disease can rapidly progress into a very critical condition. examination of radiological images of over Chest computed tomography has been coined as a potential alternative for diagnosing covid-19 patients.RTPCR may take up to 24 hours and requires multiple tests for definitive results, diagnosis using ct can be much quicker. Use of chest ct comes with significant disadvantages it is costly, exposes patients to radiation, requires extensive cleaning after scans, and relies on radiologist interpretability. lately, ultrasound imaging, a more widely available, cost-effective, safe and real-time imaging technique in particular, lung ultrasound (lus) is increasingly used in point-of-care settings for detection and management of acute respiratory disorders. in some cases, it demonstrated better sensitivity than chest x-ray in detect the disease. Doctors have recently gives the description of use of LUS imaging for disease of covid-19.Specific LUS characteristics and imaging bio-markers for covid-19 patients, which may be used to both detect these patients and manage the respiratory efficacy of ventilation. The road range of applicability and relatively low costs make ultrasound imaging an extremely useful technique in situations when patient inflow exceeds the regular hospital imaging infrastructure capabilities. However, interpret ultrasound images can be challenging task and is moved to errors due to a step learning curve.Image analysis by system automatically and deep models have already shown promise to assist clinicians to detect covid-19 associated imaging on point-of-care LUS.Different tasks on LUS images are frame-based, video-level grading and pathological artifact segmentation. At first task consists of classify each frame of a LUS image sequence into one of the four levels. Disease severity, defined by the scoring system. grading of vedio level aims to predict a score for the entire frame sequence based on the same scoring scale.

II. RELATED WORK

Deep learning has proven to be successful in a multitude of computer vision tasks ranging from object recognition and detection to semantic segmentation. Motivated by these results more recently DL has been increasing use in medical applications, e.g. for bio-medical segmentation of image or detection of pneumonia from chest X-ray. These seminal works indicate that, with the availability of data, DL can lead to the assistance and automation of preliminary diagnosis which are of risky significance in the medical community. In the wake of the present pandemic, recent works have focused on the detection of COVID-19 from chest CT. In a u net type network is used to regress a bound box for each suspicious COVID-19 pneumonia region on consecutive CT scans, and a quadrant-based filtering is exploited to reduce possible false positive detections. Differently, in a threshold-based region proposal is first used to retrieve the region of interests in the input scan and the Inception network is exploited to classify each proposed. Similarly, during a VNET-IR-RPN model pre-trained for consumption detection is used to propose within the input CT and a 3D version of Resnet-18 is employed to classify. Very few works using DL on LUS image can be found in the nooks. A dividing and weakly supervised method localization for lung pathology is described. Based on the same thought, in a frame-based classification and weakly-supervised segmentation method is applied on LUS images for COVID-19 related pattern detection CAMs are used for localization and scan the reports, in this work we exploit STN to learn a weakly supervised localization policy from the data.

III. PROPOSED WORK

Deep learning has proven to be successful in a multitude of computer vision tasks ranging from object recognition and detection to semantic segmentation. Motivated by these results more recently DL has been increasing use in medical applications, e.g. for bio-medical segmentation of image or detection of pneumonia from chest X-ray. These seminal works indicate that, with the availability of data, DL can lead to the assistance and automation of preliminary diagnosis which are of risky significance in the medical community. In the wake of the present pandemic, recent works have focused on the detection of COVID-19 from chest CT. In a u net type network is used to regress a bound box for each suspicious COVID-19 pneumonia region on consecutive CT scans, and a quadrant-based filtering is exploited to reduce possible false positive detections. Differently, in a threshold-based region proposal is first used to retrieve the region of interests in the input scan and the Inception network is exploited to classify each proposed. Similarly, during a VNET-IR-RPN model pre-trained for consumption detection is used to propose within the input CT and a 3D version of Resnet-18 is employed to classify. Very few works using DL on LUS image can be found in the nooks. A dividing and weakly supervised method localization for lung pathology is described. Based on the same thought, in a frame-based classification and weakly-supervised segmentation method is applied on LUS images for COVID-19 related pattern detection CAMs are used for localization and scan the reports, in this work we exploit STN to learn a weakly supervised localization policy from the data.



IV. METHODOLOGY

The convolutional neural networks are multiple layered networks whose architecture determines the performance of the network. It contains of three parts namely convolution layer, pooling layer, and fully connected layer. The first two together form the feature extractor and the third layer acts as a classifier. The pooling layer decreases the dimensionality of the features extracted by the convolutional layer. The fully connected layer followed by soft max uses the feature extracted to classify the images. The convolution layer takes the input image and extracts the features using a set of learnable filters. The dot product of each filter with the raw image pixel in a sliding window manner provides the 2D feature map. The linear unit helps to detect the severity. The max pooling the layer is a sub sampling layer that reduces the size of the feature map. Then the fully connected layer provides a full connection to each of the generated feature maps. declares decimal probabilities for each class in a multi class problem to classify the images. Architecture is a deep convolutional network with weights pretrained on the ImageNet Database which contains 3.2 million clearly annotated images of 5247 categories. Thus knowledge in form of weights, architecture and features learnt on one domain can be transferred to another domain by Transfer Learning on such pretrained models. The features are generic in the early layers and more dataset specific in the later layers. In the proposed model the initial five blocks of convolution layers are stuck for behaving as a feature extractor which is the benefit of CNN over traditional techniques and the last dense layer followed by soft max layer is used to classify.

V. IMPLEMENTATION

A. Experimental Setup The experiment was performed on a Windows 10 PC equipped with GPU card P4000, 64-bit Operating System. The CNN-based model was implemented in the Keras 2.2.4 deep learning framework with TensorFlow 1.13.1 backend and python 3.7.2.

B. LUS images

The images are collected from the various hospitals and laboratories as well as from the internet.

C. Image Preprocessing

The images collected are resized to 224*224 pixels and a number of augmentation techniques like zoom, rotation, horizontal and vertical shift are applied using ImageDataGenerator in Keras to generate new images.

D. CNN Model Training The image data set is loaded for the training and testing. The class labels and the corresponding images are stored in respective arrays for training. 70 percent of data is used for training and 30 percent of data is used for testing using the train_test_split function. The 70 percent data is further split and 20% of it is used for validation. The class labels are encoded as integers and then, one-hot encoding is performed on these labels making each label represented as a vector rather than an integer. Next, the VGG-16 model is loaded from Keras, and the last fully connected layers are removed. The remaining layers are made non-trainable. We have flattened the output of the feature extractor part, followed by a fully connected layer and an output layer with softmax. Then we have compiled our model using the Adam optimizer with categorical_crossentropy as the loss function for classification. We have stopped at25 epochs since after this the results were stable. Figure 3 shows the steps we have executed for the classification process.

VI. FUTURE ENHANCEMENT

Such methods are benefited to save human life and it is evident that diseases can be predicted before they affect the whole body. For the last few decades, the computer vision research community is trying to reduce this gap by developing automated systems which can process medical images using machines to make decisions. proposing a deep convolution network based approach that is assists doctors and physicians in making reasonable decisions. The results obtained from the proposed method outperformed state-of-the-art methods that are reported for the same dataset. In the future, To explore large-scale image datasets for medical image classification and detection problems.

VII. CONCLUSION

For classification purposes, a deep learning-based framework for medical image classification by training the images is proposed. In regards disease is one of the main requirements of the existing conditions and investigated or examine to specific diagnasis. The use of computer tools and reliable images analysis is the main aspects that can improvee the efficiency of clinicians and physicians. It is a required of the current situation to develop such imaging processing methods that can help doctors in various processses of medical department.

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