National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Development of feature extraction and classification models for skin lesion Analysis
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Abstract	: This dissertation focuses on the design of automated skin lesion classification systems (SLCS) to assist dermatologists in making lesion decisions. Our research primarily involves the proposition of different feature extraction methodologies, feature learning methodologies, and classifiers to detect skin lesions from dermoscopic images. This dissertation proposed four approaches for skin lesion classification. First approach is based on handcrafted feature extraction and classification. The latter approaches are based on deep features. The first contribution proposes a derived feature set for skin lesion classification. The imbalanced classification challenge is addressed using fuzzy classifier. The Graph-based fuzzy classifier is improved by using a modified membership function to provide more importance to minority class compared to majority class. The second contribution proposes a novel method by analyzing both dermoscopy images and wavelet images. In this regard, a standard pre-trained ResNet50 model is used for extracting deep features. Lesion images are transformed to wavelet domain using lifting wavelet transform (LWT). The level-2 approximation component of LWT is taken as wavelet feature. Deep features from dermoscopy images and wavelet features from wavelet images are fused, and the neighborhood component analysis (NCA) algorithm is subsequently used to select a subset of fused features with reduced dimensions. The NCA-reduced feature set is classified by a multilayer perception. This study demonstrates that the integration of LWT features improves discriminative information. The third contribution, proposes a customized deep convolutional neural network (CNN) architecture designed to discriminate between benign and malignant lesions. The model is designed carefully with fewer convolution layers, fewer filters, and parameters to achieve better classification performance compared to pre-trained VGG16, ResNet50, and InceptionV3 models and, ensures state-of-the-art performance. The proposed model is composed of nine trainable layers: eight convolution layers and one fully connected layer. The memory requirement of the proposed model is reduced compared to pre-trained deep models. The forth contribution proposes a hybrid model to classify multiclass skin lesions. This chapter proposes a hybrid model combination of pre-trained ResNet50, pre-trained VGG16, and the Vision Transformer (ViT) model. The Pretained ResNet50 and VGG16 are used for patch extraction from input lesion images. The ViT is trained using these patches. This hybrid model takes advantage of both local and global information to classify lesion images. Keywords : Skin lesion classification; Handcrafted feature; Fuzzy SVM; LWT; NCA; Deep Learning Model; Vision Transformer.