Automatic Classification of Pollen Grains using Deep Learning Technique

Muhammad Khubayeeb Kabir(ID 19101168)
Anika Nahian Binte Kabir(ID 18101249)
Mayesha Monjur(ID 18101411)
Shihab Sharar
Annajiat Alim Rasel

1 Abstract

Palynology is an important biological field where Deep Learning can bring immense benefits. Often morphological and textual features are not always detectable by the human eye. Considerable human resources are needed for analyzing the structure of pollen grains under a microscope. It is an essential step in forecasting health risks posed by pollen-induced allergies. Using deep learning techniques to process microscopic images of pollen grains has proven to be very effective. In this research, an imbalance dataset of 13,000 microscopic pollen grain images, the Pollen 13k Dataset by IpLab, is used for classification. The pollen grains belong to several classes such as Corylus avellana , Corylus avellana , Alnus , Cupressaceae and an additional class of objects called Debris.

In recent years, many deep neural networks have been developed which are compatible with the pre-existing classical models like LeNet-5, AlexNet, VGG 16. AlexNet and VGG have been used in the pre mentioned research and some other networks such as SeResNext and EfficientNet have been used for pollen grain classification previously. With that in mind,we decided to use the Dense Convolutional network or DenseNet for pollen grain classification as our primary goal for better classification results. Dense Convolutional Network or DenseNet works by concatenating each layer's feature map to the input of every successive layer within a dense block which encourages the next layers to obtain the features from earlier networks and use them as needed. This increases variation among subsequent layer's input and thus increases efficiency. Among DenseNet's several advantages, vanishing-gradient problem, strengthening feature propagation, encouraging feature reuse, and substantially reducing the number of parameters are most prominent. Compared to ResNet models, DenseNet models have shown better performance with less complexity thus it may provide better results.

2 References

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