**Summary of The paper**

The purpose of the paper is to show how different computer vision methods can be applied to solve certain biomedical problems. This paper reviews computer vision applications such as image classification, image segmentation, object tracking, and Augmented Microscopy. Being more specific, this paper is focused on how deep-learning has broaden the range of application where computer vision can be applied.

Moreover, the fundamental importance of having a annotated dataset with low errors and various methods to tackle the problem of having limited data have been mentioned. Computational approaches such as Data-augmentation techniques, normalization and transer learning are refered. The importance of hardware is also mentioned as training large datasets requires millions of parameters. There are three boxes that divides the rest of the paper in three parts. The Box 1 is on training a linear image classifier. Training starts with calculating the class scores by taking the dot product of initialized weight and the given input data. Then, this class scores are passed through softmax activation function which calculates the relative score which is then used to calculate the cross-entropy loss. This cross-entropy loss punishes wrong values when comparing with the target variables. Then using backpropogation, weight are updated with the learning rate and gradient of the loss function. Next, the common mathematical components of deep learning models are shown in the figure.

Following box is about troubleshooting and measures to consider to solve most problems in biomedical domain. First measures is cheking the training performance as for binary classification, the accuracy below 50% means that we made some errors and is is performing worse than random chance. Another measure is overfitting, which happens if we fit large model on small dataset or if we train the model longer than usual. Third measure is class imbalance which simply means that each class in the dataset should have same number of records/images. Moreover, assessing the performance metrics after performance is also a good practice. The fifth measure is hyperparameter optimization which is setting values that can not be learned by the model but which is set by different methods. These methods can be either applying human knowledge or using other automated methods. Last two measures are software engineering and dimension mismatch.

Next the paper reviews biological applications of deep learning which are mentioned above. The first application explained is image classification in which applications of image classification are listed. It also evaluates the use of deep learning in feature extraction which tackles the limitation of labeled data. Next is image segmentation which is partitioning an image into smaller parts to identify features. Comparison has been made between Instance segmentation and semantic segmentation. The application of image segmentation is mentioned in the field of unsupervised learning. Third application analyzed is object tracking which is following the object through time. It is an integration of object detection and object linkage. Last application is Augmented Microscopy which is used to extract the inferred information from biological images.

The paper seems quite intuitive and covers a lot of information about computer vision and its application in biomedical analysis. I truly believe that solving biological analysis problems would be the next big step for deep learning.