The research paper on “Deep learning for cellular image analysis” talks about the machine learning and computer vision techniques like deep learning on biological images. Earlier this image analysis was done in MATLAB, but as the technology advances and development to a lot of open source libraries, we have moved to use deep learning models for these image classification problems.

While using deep learning techniques, training data is critical, since collecting the high quality data often takes much time. Once we have data we have to apply a few Data Pre process techniques like augmentation operations such as rotation, flipping, zooming and normalization methods like rescaling etc. Once the training data is available we can use the deep learning model for predictions and evaluations. There are several ways to do this, but currently python is the best way which uses some open source libraries like Keras/Tensorflow, Pytorch, CNTK, THEANO etc. If we don't have limited data for training we can use the transfer Learning approach in which we choose a pre-trained model and apply feature extraction on the pre-trained model. We have several methods to do that like using TF hub models or using the Keras applications which have VGG, INCEPTION, RESNET and a lot more networks.

In this paper they have mentioned a few steps on how to use the deep learning model for biological image analysis. There are
**Training a Linear Image Classifier :** In this they mentioned about the model architecture and how the model should be built. They have given some common mathematical components of the deep learning model like CNN layers, Pooling, Dense, regularisation methods like L2 regularization, Batch normalization , Dropout and so many. By using these components we can build a deep learning model which trains and yields the best performance of the particular task.
**Troubleshooting :** Here they have mentioned some issues and their solutions that arise in deep learning models like Training performance, Overfitting, Class imbalance, Assessing Performance, Hyper Parameter Optimization, Dimension Mismatch and Software Engineering.
**Glossary:** This step involves the results of the deep learning model which includes, model overfitting, underfitting, transfer learning, choosing epochs, batch_size, cross validation and choosing metrics like precision, recall, f1_score, jaccard index etc.

They have also mentioned about the Biological applications of deep learning which includes
**Image classification:** This includes building the deep learning model either from scratch or using the pre-trained networks which classifies the given input and predicts what class the input image belongs to.
**Image Segmentation:** This includes the task of partitioning the image into several parts to identify meaningful objects or features.
**Object tracking:** Object tracking is the task of following objects through a series of time-lapse images.
**Augmented microscopy:** Augmented microscopy is the extraction of latent information from biological images, such as the identification of the locations of cellular nuclei in bright-field images137.
They concluded the paper by talking about the advantages, what kind of data can be used like two dimensional or 3 dimensional and what else can be done to encourage these techniques.