FINAL RESEARCH PAPER

PROJECT TITLE- CELL TRACKING CHALLENGE

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ABSTRACT

This document based on completion for cell tracking challenge. This document provided information for challenging task for tracking movement of cells & segmenting cells in such sequence of time lapse. The discussion of the cell moving tracking with the machine tracking for this report are the moving cells have diseases & migration cells. There are two types of dimensions that are applicable for the taking of cell is three dimensional 3D & two dimensional 2D both for the data. The machine learning algorithms provides the accessible functionality towards the tracking of cells in the body such that this project could be utilized for the medical purposes. This SVM model algorithm is effective for the analyze of labeled data set in the training method, while this model provides the functionality towards the classification of such problems using testing method, by categorizing new data set of testing.

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INTRODUCTION

This report discusses for the cell tracking challenges using the algorithms of the Machine learning. The tracking of the moving cells and the segmenting the cell in sequence of the time lapse is a task for challenge, there is required the more application for industrial settings & scientific both (Uddin, et al., 2019). In this report, characterizing the shapes of cell changing & moving, when interaction with entire environment to understand mechanobiology for migration cell & implications, there is various for the diseases and development of normal tissues both. The discussion of the cell moving tracking with the machine tracking for this report are the moving cells have diseases & migration cells. The challenging task faced during the tracking of cell, the comparison & evaluation of the entire cells & segmentation of the nucleus, for the method of tracking there are used 2D & 3D both time lapse for microscopy videos of the nuclei & cells, with the generation from computer of video sequences (2D & 3D) simulating for the nuclei & entire cells that were move in the real environment. The process for locate an object that was moving from the tracking in the computational object is in the sequential image. The approach for the cell is used as the tracking object from computer is applied for many purposes (Othman, et al., 2018).

There are several applications for the taking of live object. There are Three Types of method for the tracking of cell such that tracking by the filtering, taking by the evolution of model, and tracking by detection. There are two types of dimensions that are applicable for the taking of cell is three-dimensional 3D & two dimensional 2D both for the data. The support vector machine is a type of supervisor ML algorithm which are used for the regression of challenges & classification. Coordination of the individual observation are simple from the support vector. This support cutter machine frontier which best segregates for the hyper plane and line.

MACHINE LEARNING MODEL

There are three main models that are used in the machine learning and these models are defined as supervised learning, reinforcement learning and un-supervised learning (Morais & Pedro, 2018).

- In supervised learning, examples are used for making better learning of the machine. The datasets that are provided in the machine learning is known and by using these datasets machine is trained and output and input is also provided to get better results. The data patterns can be easily identified by using these machine learning algorithms. The supervised learning contains forecasting, regression and classification. In the classification part, the values that are provided to the task are used to draw a conclusion. This is helpful and observes the existing values that are defined in the task. In forecasting, the dataset of past and present is considered that helps in providing better estimations on the future requirement (Mankodi, et al., 2020). It helps in analyzing the trends in efficient manner. In regression, the variables that are used in the task is considered and the relation of variables can be determined.
- In unsupervised learning, patterns are identified by using machine learning and the algorithms provided by machine learning. The instructions that are provided to the machine are not done by human being or any instructor. The data that is provided in the data set is analyzed using machine in easy manner. The structure is provided by the unsupervised learning so that data can be easily identified. In unsupervised learning, dimension reduction and clustering are used.
- Reinforcement Learning provides learning that is based on regimented learning. In this type of learning, machine is provided with values, parameters and actions. Using these parameters that are provided different possibilities and options can be explored ad helps in achieving the result that is optimal. The errors that may arise in the machine can be solved by providing training to the machines and helps in getting best results.

In this report the model that is preferred for the machine learning is support vector machine (SVM). The support vector machine that is used in this report is based on the supervised learning. The data that is used in regression and classification can be analyzed in efficient manner. In this learning, the data that is used in data set is filtered so that better results can be determined. For filtering data, training is if helps in achieving the results. The support vector machine (SVM) is non-linear and linear in type (Hantke, et al., 2018). In non-linear type SVM linear lines are not useful in separating and high dimensional data can be mapped to classify the data. In the linear SVM, straight line can be used to classify the data in efficient manner.

EXPERIMENTAL RESULTS

In this part the screenshots that are used here is discussed so that better understanding can be makes on machine learning algorithm.

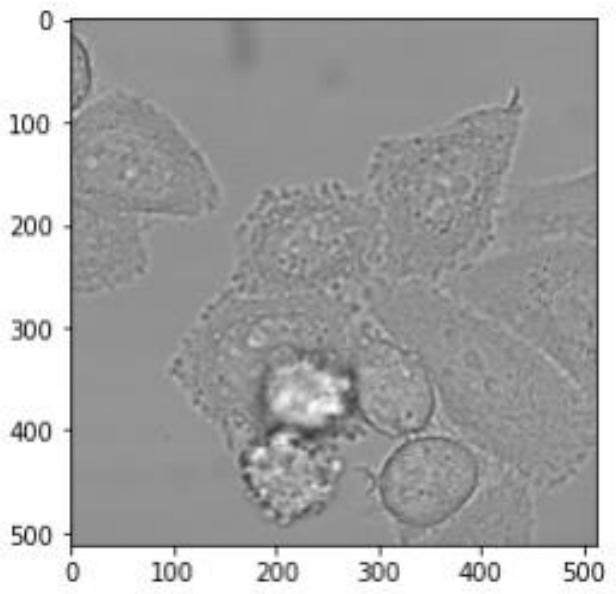

Figure 1

Training Dataset

In this figure the data set that is provided performs preprocessing steps. In this step, the data set is resized and append to the existing data set so that better results can be obtained. This data set is important as it helps in collecting information about the cell tracking (Emami, Sedaei & Ferdousi, 2021). The python is used that helps in performing preprocessing step in effective way.

```
for category in CATEGORIES:
    path=os.path.join(DATADIR, category)
    for img in os.listdir(path):
        img_array=cv2.imread(os.path.join(path,img))
        plt.imshow(img_array)
        plt.show()
        break
    break
```

Figure 2

Creating dataset using 2D

The NumPy code is provided that helps in analyzing the data set and by analyzing the data better preprocessing steps can be provided.

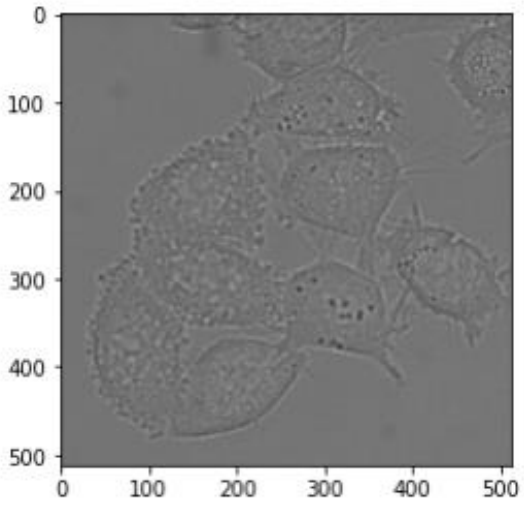

Figure 3

Creating dataset

In this figure the data set that is necessary for performing preprocessing is created so that processing can be proceed in better way. For creating data set, code is required that creates data set required for preprocessing. The preprocessing is an essential part in machine learning as it helps in providing better quality to the data set.

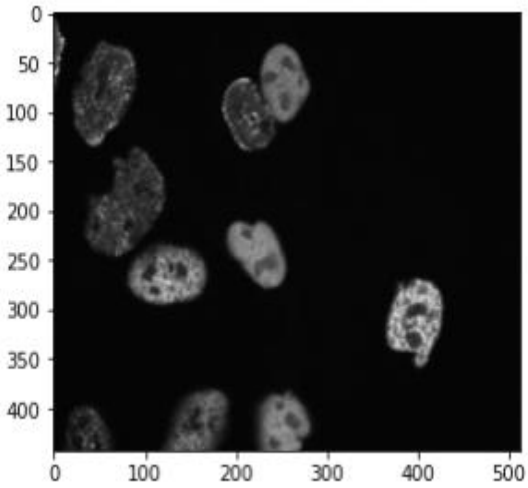

Figure 4

3D data set performing preprocessing

The use of 3d dataset for performing preprocessing steps is essential and helps in identifying the data set in efficient manner. By using 3D data set the real time environment can be viewed that helps in determining the nuclei cell.

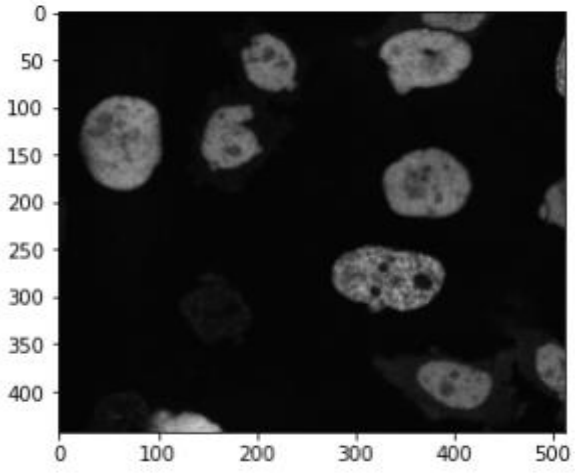

Figure 5

Creating dataset using 3D

By creating the data set required in training, 3D data set can be used. The analyzing of the data in 3D dataset can be make easier and helps in collecting data set for processing in detailed way.

```
for category in CATEGORIES:
    path=os.path.join(DATADIR, category)
    for img in os.listdir(path):
        img_array=cv2.imread(os.path.join(path,img))
        plt.imshow(img_array)
        plt.show()
        break
    break
```

Figure 6

Creating data using 3D

Here the code is provided that helps in collecting and analyzing data in efficient manner. The code and analyzing of the data is based on NumPy that helps in analyzing data set in better way.

By observing the practical it is determined that the data set that is provided above can be analyzed in efficient manner. The cell tracking analyzes can be made effective using HeLa cells. NumPy, matplotlib and pandas is used that are defined as libraries of the Python are also considered for analyzing the data present in data set. The figures are shown that represents the results defined by analyzing of data set.

DISCUSSION

This document has extensively discussed upon the implementation for the cell tracking challenge. This document provides required information that is needed for the implementation for such machine learning models and algorithms, for performing the required prediction and for understanding the impacts for cell migration procedures (Huang, et al., 2018). The machine learning algorithms provides the accessible functionality towards the tracking of cells in the body such that this project could be utilized for the medical purposes. This document has provided the explanation towards the machine learning model, utilized for the purpose of tracking cells which migrates around. This document provided an in-depth description for the study performed for such task of movement tracking for moving cells. The traversal that the cells perform is discussed and this project of cell tracking challenge has helped towards the understanding. This understanding and comprehension for how the cells performs changes in the cell shape, throughout their interaction with the conditions and objects that are present in the surrounding environment. This project has provided extensive information and data through the utilization of the data set which has been used for understanding the impact that occurs due to the several movements of the cells.

The machine learning model algorithm for SVM has been utilized in this project. The SVM is chosen and utilized for such project, is due to the fact that the cell tracking issue could be described as classification problem. Due to which, the usage for the classification model of SVM have been performed (Emami, Sedaei & Ferdousi, 2021). The support vector machine i.e., SVM model provides the results and outputs in the categorical format which is based upon the classes that are distinguished from each other. These unique classes have provided the means for assessing the results in regard to the movement of cells. This SVM model algorithm is effective for the analyze of labeled data set in the training method, while this model provides the functionality towards the classification of such problems using testing method, by categorizing new data set of testing. There are four sets of 2-d and 3-d training and challenge data are pre-processed such that the data set pre-processing have not been required.

The SVM model has been provided with two different data sets for the cell movement which are in the format of 2-d and 3-d data. The model has been trained upon the training data set for 2-d and 3-d data sets. Then the model is evaluated through the usage of testing data set which did not consist of labelled output feature. The accuracy of 2-d classification for the categorization with the training set have been 98.27 % and with challenge set, accuracy have been 97.62 %. The classification accuracy of 3-d datasets for training and challenge set have been 100 % for both. The SVM model of the machine learning algorithms have been evaluated to be effective and performance for the classification task of cell tracking challenge.

CONCLUSION

In this report, machine learning model is used that helps in tracking the cells in efficient manner. The use of Python language is preferred so that data set that is provided in the report can be analyzed in efficient way (Bisong, 2019). Cells and nuclei are also defined in this report. The use of machine learning model is also described in detail. The dataset that is used in this report is 2D dataset that helps in analyzing the data in efficient manner and the use of SVM algorithm is also preferred. Visualizations can be created in effective way.

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