Group Trajectory Analysis in Sport Videos

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I. Objectives

Due to the current advancements in automated cars like the new Tesla, trajectory projection plays a major role in the entire design and working of their systems. Predicting other traffic participants trajectories is a crucial task for an autonomous vehicle, in order to avoid collisions on its planned trajectory, since it depends on each driver's intention and driving habits. In this paper, we address try to address the issues with complex trajectory prediction. We implemented a trajectory prediction model on NBA game data set. we propose a Trajectory Prediction Model which utilizes Transformer Neural Networks. Transformers were developed to solve the problem of sequence transduction, or neural machine translation, including tasks that transforms an input sequence into an output sequence.

II. Related Work

Forecasting trajectory and behavior of road-agents using spectral clustering in Graph-LSTMs, An approach for traffic forecasting in urban traffic scenarios using a combination of spectral graph analysis and deep learning. Graph Clustering is the process of grouping the nodes of the graph into clusters, considering the edge structure of the graph in such a way that there are several edges within each cluster and very few between clusters . multiple objects forecasting model predicting future object locations in diverse environments, This paper introduces the problem of multiple object forecasting (MOF), in which the goal is to predict future bounding boxes of tracked objects. they formulate the problem based on the perspective of an agent and call for the prediction of full object bounding boxes, rather than trajectories alone.

	DeepSort	KCF
YOLOv4	19.320	21.814
Faster R-CNN	8.358	9.498

Table 1. Mean Average Deviation for the trajectories predicted

	DeepSort	KCF
YOLOv4	38.751	40.325
Faster R-CNN	15.745	16.879

Table 2. Final Average Deviation for the trajectories predicted

III. Framework

We propose a trajectory prediction model with transformer networks as it core prediction block. Our model consist of three blocks, (i) Object Detection, (ii) Object Tracking , (iii) Trajectory Prediction. In our object detection block, we implement a Faster R-CNN object detection. In the object tracking block we used DeepSort Object detection. We chose these models because of its high detection accuracy and the trackers ability to avoid fake positives. In the Trajectory prediction block we implemented Transformer Networks model. Transformer Networks preforms well in sequence-to-sequence analysis, because it uses attention mechanism. Trajectory prediction can also be interpreted as a sequence-to-sequence problem since it uses the previous sequences(trajectory) to learn the correlation between the movements of the agent to predict the feature trajectory of the that agent.

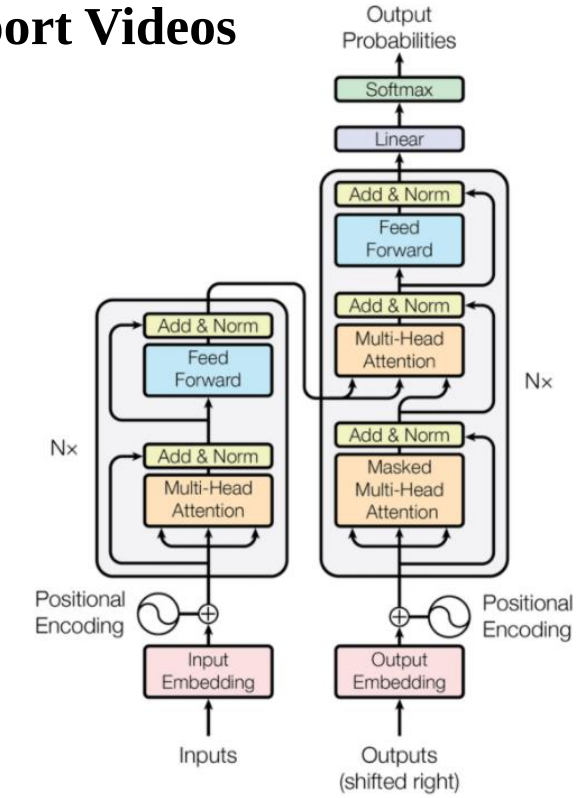

Figure1. Transformer Networks framework

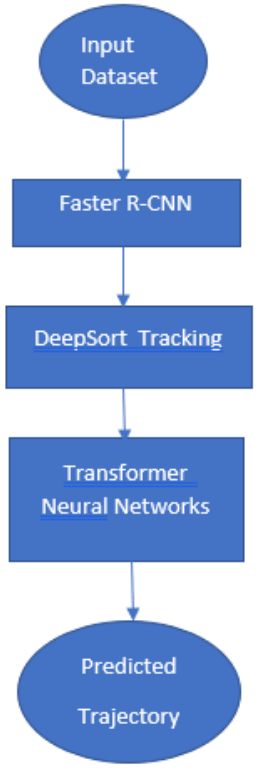

Figure 2. Model Flowchart

IV. Implementation & Results

We implement different models for tracking and object detection. Secondly, we implemented Transformer network for trajectory prediction. Through the experimentation we found that the object detection and tracking model have huge impact on the final trajectory prediction. Even though we have high MAD and FAD, it is still can be further improved by implementing a better object tracking and detection algorithm. Since, our model is generalized for all the players, it does not capture those features. We conclude that our model has improved result, but still it cannot produce good enough result which can be used for real time analysis. We can try different tracking algorithm and object detection algorithm, since we found out from our explements that extracting proper trajectory from the dataset leads to better prediction. We believe this will encourage more research work in the future. With the improvement in the tracking and object detection technology along with improved trajectory prediction model will get us close to predicting accurate trajectories.