Motion and Goal Conditioned Trajectory Density Estimation

A Project Report for CSN-400A (B.Tech Project) of Autumn Semester 2023-2024

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14/11/2023

Candidate's Declaration

I declare that the work carried out in this report entitled "Motion and Goal Conditioned Trajectory Density Estimation" is presented on behalf of the fulfilment of the course CSN-499A submitted to the Department of Computer Science and Engineering, Indian Institute of Technology Roorkee under the supervision and guidance of Prof. Pravendra Singh and Prof. Neetesh Kumar, Dept. Computer Science and Engineering. I further certify that the work presented in this report has not submitted anywhere for any kind of certification or award of any other degree/diploma.

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Place: IIT Roorkee

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Certificate

This is to certify that the above statement made by the candidates is correct to the best of my knowledge and belief.

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Place: IIT Roorkee

(Signature of the Supervisor)

Candidate's Declaration

I declare that the work carried out in this report entitled "Depth First Search in the Semi-Streaming Model" is presented on behalf of the fulfilment of the course CSN-400A submitted to the Department of Computer Science and Engineering, Indian Institute of Technology Roorkee under the supervision and guidance of Prof. Shahbaz Khan, Dept. Computer Science and Engineering. I further certify that the work presented in this report has not submitted anywhere for any kind of certification or award of any other degree/diploma.

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Abstract

Trajectory prediction is not determined just by using past trajectories but also on stochastic factors and environment details. For predicting pedestrian trajectories one must take into account the inherently stochastic nature of human behavior, at any point in time the agent may turn right or keep going straight with equal likelihood. If there are such factors then for forecasting the future actions of an agent we must first estimate where the user wants to go by producing a goal distribution for possible goal positions of an agent taking into account the scene details and the agent's dynamic features which are not just confined to the past velocities but also on walking style, way of dealing with obstacles and any other information from LIDAR this is crucial because many of the existing models do not consider the dynamic constraints and visual information of the environment around them. In this report we propose an upgrade to an existing architecture of a model called FlowChain, a normalizing flow based trajectory prediction model. The upgrade is in the form of an augmentation to the conditioning of the flows by using additional information in the form of a plausible goal position. The new model will be a normalizing flow based trajectory prediction model with goal conditioned input which gives a multi-modal probability distribution for human trajectory prediction. It will allow a rapid analytical computation and reliable fast update of the estimated distribution by incorporating the new observed positions of the agent and reusing the grasped trajectory patter.

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1.1 Objective

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2 Previous Work

The field of human trajectory prediction is an import field of study in research and is marked by a diverse range of research that aims to address the indeterministic nature of human motion. Various techniques have been explored to decrease prediction error, including some cutting-edge approaches such as Variational Autoencoders (VAEs), Generative Adversarial Networks (GANs), LSTM-based methods[1], transformer-based methods, and more recently, Graph Convolutional Networks (GCNs). Each of these methods brings a unique perspective to the challenge of predicting human trajectories, leveraging advancements in machine learning. In this paper we are going to focus on one such technique Normalizing Flows.

2.1 Maths Behind Normalizing Flows

Below is the advancement we are using, with each successive method surpassing the capabilities of its predecessor. This sequence of advancements is the foundation of our approach to modelling and predicting the future probability distribution of the positions and trajectory.

Figure 1: Figure 1: Your Caption Here