AI- Project

Modified Task and Models for Intention prediction

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Outline

Goal Statement

- **Collaborative Task:**
  Robot has to pick up a raw material from Location A and drop it in Location B. **Robot has to pick up a tested material from the tested material pool(Location C) and puts it on assembly line (Location D). This task is atomic and cannot be stopped in between to serve human.**
  Human will be waiting for the raw material in Location B and when he gets the raw material, Human performs his analysis on the object and after he is done with the task, he will ask for the raw material.
  Our goal is to reduce idle time of human, we do this by predicting his *task* time so that the robot can complete its part without any delay for the human side.

Prediction Model

Based on the outputs of the *Perception* model, *i.e* a series of timestamps $t_i = (s_i, f_i)$ where s_i is *Started Waiting* timestamp and f_i is *Finished Waiting* timestamp, we predict the next *Started Waiting* timestamp (s_{i+1})

Prediction Model

- **Linear Regression:-** We use it to determine the extent to which there is a linear relationship.
- **Support Vector Regression:-** Support Vector Regression using Non-Linear Kernels will help in modelling non-linearity of the dataset. While this might not help in achieving accurate results, we hope to use this as a measuring stick
- **Autoregressive Models:-** An autoregressive model is when a value from a time series is regressed on previous values from that same time series.

Autoregressive Model

- To predict the next timestamp (s_{i+1}), a window of last x timestamps is taken as training input.
- We use $\tau_i = f_i - s_i$ to denote idle time of employee and $w_i = s_{i+1} - f_i$ to denote working time of employee.
- As our goal is to reduce idle time, the cost (C_i) is proportional to τ_i.
- Hence we put forth the following prediction model

$$w_{n+1} = \alpha_x * w_n + \alpha_{x-1} * w_{n-1} + \cdots + \alpha_0 * w_{n-x}$$

where $\alpha_i = 1 - C_i$

Milestones

Schedule Planning	
Date	Expected Work
2^{nd} February, 2017	Implementation of Perception module in Python
9^{th} February, 2017	Implementation of Intention Prediction/Evaluation in Python
16^{th} February, 2017	Implementation of Planner in Python
23^{rd} February, 2017	Implementation of Action Renderer in Python
9^{th} March, 2017	Integrating all components and Testing
16^{th} March, 2017	Rendering actions using ROS/SWI-Prolog/Robot Studio for a simple task
23^{th} March, 2017	First Draft Submission