A Driver’s Assistant: Finding the best Petrol Station

Introduction

Popular vehicular applications are limited to Sat Navs which find routes from an origin to a destination.

- Q1. Route Planning
  What is the best way of choosing a route from A to B?
- Q2. Finding Petrol Stations
  Could Sat Navs be used to help a driver find the best petrol station to go to when a vehicle runs low on fuel?

Route Planning

- Two main type of route planning methods
  1. Shortest Path Methods: routes are chosen based on shortest distance or shortest time.
  2. Simplest Path Methods: routes are chosen based on how simple they are.
- Combine these two methods to find the best route.
- The following formula gives the cost function for a route $R$ where $i$ are the road segments making up $R$. This is used in conjunction with the A* search algorithm to efficiently search for optimal routes.
  \[
  \text{COST}(R) = \sum_{i=1}^{n} \left( \text{TravelTime}_i + \text{RoadDelay}_i + \text{TurnDelay}_i \right) + \text{RoadTypeWeight}_i + \text{LaneNumberWeight}_i + \sum_{j=1}^{m} \text{TurnWeight}_j.
  \]

Petrol Station Information

- Acquisition of Petrol Station Information
  - Vehicles are fitted with SatNavs and cameras. Images of the roadside are automatically taken at regular intervals while the vehicle is moving.
  - Each image is analysed to check for the presence of a petrol station and if detected, fuel prices are found. Prices and GPS location are then sent to a central server.
- Use of Petrol Station Information
  - Fuel gauge registers low while driving along planned route.
  - Sat Nav gets up-to-date information from server about petrol stations in the vicinity and chooses a route to destination via the “best” petrol stations.

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Image Processing

- Make Greyscale
- Threshold
- Dilate
- Crop
- Erode

Choosing Petrol Station

- The cost of driving to a cheap petrol station may outweigh the savings in getting cheaper fuel.
- It may be more economically beneficial to drive to a closer petrol station with dearer fuel prices.
- The cost of driving to a particular station (travelling some ExtraDistance to do so) is given as; \[
  \text{EuroSpend} = \left( \text{FuelConsumption} \times \text{ExtraDistance} \right) + \text{FuelPrice} + \text{TankSize}
\]
- Not only is this EuroSpend cost taken into account but the route planning cost is also examined.
- A weighting is used to combine the two.
  \[
  \text{TotalCost} = \text{EuroSpend} \times w + \text{COST}(R) \times (1 - w)
  \]