**Technical Report: Forecasting Daily Public Transport Passenger Journeys Using Prophet**

**Introduction**

This report describes using Prophet, an open-source forecasting tool developed by Facebook, for predicting daily public transport journeys. Prophet is ideal for time series data with seasonality and trend components, as it decomposes data into trend, seasonality, and holiday effects.

**Algorithm Overview**

Prophet uses an additive model composed of:

- Trend: Captures long-term data trends.

- Seasonality: Accounts for weekly, monthly, or annual patterns.

- Holiday Effects: Models specific holidays/events causing anomalies.

**Model Parameters**

1. Trend:

- growth: Defines trend type; ‘linear’ for steady growth or ‘logistic’ for capped growth.

- changepoints: Detects significant trend shifts.

- changepoint\_prior\_scale: Adjusts changepoint flexibility, affecting trend shifts.

2. Seasonality:

- yearly\_seasonality: Activates yearly patterns using Fourier terms.

- weekly\_seasonality: Enables weekly passenger trends.

- daily\_seasonality: Optional, useful for high-frequency data.

3. Holiday Parameters:

- holidays: Defines significant dates (e.g., public holidays).

- holiday\_prior\_scale: Adjusts model sensitivity to holiday effects.

4. Uncertainty Intervals:

- interval\_width: Sets uncertainty range, typically 0.8-0.95.

- mcmc\_samples: Adds Monte Carlo sampling for accurate uncertainty intervals.

**Model Fitting and Forecasting**

The Prophet model was trained on historical transport data by transport mode (e.g., Local Route, Light Rail) with ‘Date’ as ‘ds’ and passenger counts as ‘y.’ The model generated forecasts over a seven-day period, offering insights into daily demand.

**Results and Visualization**

The forecasts were visualized to show trends, seasonal patterns, and holiday deviations, providing insights for each transport mode. Visualizations included confidence intervals and correlation heatmaps, highlighting demand fluctuations.

**Conclusion**

The Prophet model accurately forecasts daily public transport usage, capturing key trends and seasonality. The forecasts aid in strategic planning and optimizing resources for peak and off-peak periods, supporting effective network management.