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PASSENGER JOURNEY INSIGHTS AND FORECASTING

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Insights Report:

- Light Rail and Rapid Routes handle most of the weekday passenger load. Their high ridership during these days highlights their importance in reducing road traffic and serving office workers. This suggests investment in these services can have a direct impact on easing congestion in the city.

- School Routes experience sharp increases on school days, dropping drastically during holidays. This indicates that these routes are vital for students' access to education, and planning for additional capacity during school terms can improve service reliability.

- Passenger numbers on Local Routes drop during rainy days and holidays, while Light Rail ridership spikes during major events. This shows that while Local Routes are more sensitive to weather, Light Rail is seen as a reliable option for mass events, and future planning should consider weather resilience for Local Routes.

- Ridership across most services is slowly recovering after the pandemic, but Local Routes and Light Rail are leading this recovery. This suggests that commuters are regaining confidence in using public transport for daily travel, and continued improvements in these services could accelerate full recovery.

- There's a strong relationship between Light Rail and Peak Services, indicating they cater to a similar commuter base. When School Routes drop during holidays, Local Routes see a rise in family and leisure travellers, showing how different services support changing travel needs.

Technical Report: Forecasting Passenger Journeys Using Prophet

Introduction

For forecasting the number of passengers on five public transport services — Local Route, Light Rail, Peak Service, Rapid Route, and School — I chose the Facebook Prophet model. This model is great for time series data like ours because it can handle trends, weekly patterns, and special days such as holidays, which all affect how many people use these services.

Why Prophet?

Prophet is designed to work well with time series that have clear seasonal patterns and changing trends. It automatically detects when trends shift and can include holiday effects, which is important since public transport usage can vary a lot on holidays or school breaks. This made Prophet a natural fit for our dataset.

Preparing the Data

I cleaned the data by filling in any missing days and making sure everything was organized by day. I also created a calendar of holidays and school breaks to help the model understand when passenger numbers might go up or down unexpectedly.

Key Model Settings

- **Changepoint Prior Scale (0.05):** This setting controls how flexible the model is in detecting trend changes. A value of 0.05 lets the model adjust smoothly without overreacting to small fluctuations.

- **Seasonality Mode:** I used multiplicative seasonality because passenger counts tend to rise and fall in proportion to the overall level, not by a fixed amount.

- **Weekly Seasonality:** Enabled to capture differences in ridership between weekdays and weekends.

- **Daily Seasonality:** Not used since the data is daily, not hourly.

- **Holidays:** Incorporated to adjust forecasts around public holidays and school breaks.

How the Model Was Used

I built separate models for each transport service using past data and tested how well the forecasts matched real observations. Then I used the models to predict passenger numbers for the upcoming week. The forecast results aligned well with historical patterns.

Benefits of Using Prophet

Prophet handles missing data and outliers well and can easily incorporate multiple seasonal effects. It also gives understandable outputs breaking down trends and seasonal influences, which makes interpreting the results straightforward. Plus, it's fast to set up and requires little manual tuning.

Conclusion

Overall, Prophet is a strong choice for forecasting passenger journeys in public transport due to its flexibility and ability to model real-world effects like holidays. The 7-day forecasts for all five services will be useful for planning and improving service efficiency.