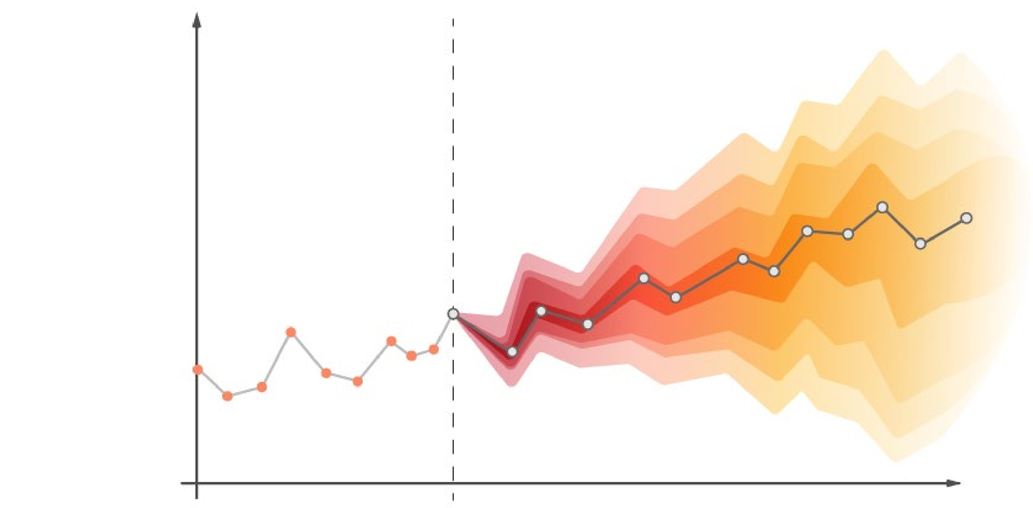
Paris City Brain: City-Scale Traffic Flow Prediction

Shuo Wu(Wushuo123@sjtu.edu.cn), Yifei Ma(shenjidf11@sjtu.edu.cn)
ACM Honors Class 2022, Shanghai Jiao Tong University

上海交通大學 SHANGHAI JIAO TONG UNIVERSITY

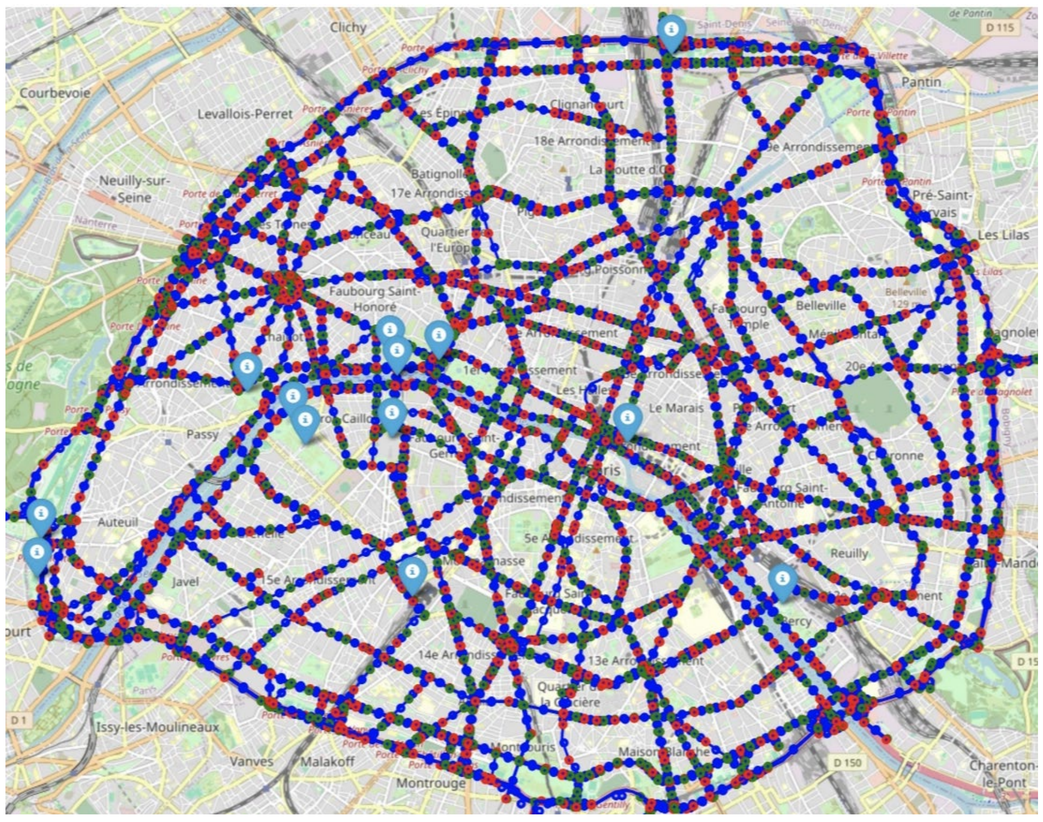
Background

Time-Series Forecasting



Given historical data $\{X_1^t, \dots, X_C^t\}_{t=1}^{L}$($t$ denotes timestamp, $1 \dots C$ denotes variates), predict $\{X_1^t, \dots, X_C^t\}_{t=L+1}^{L+h}$, where h is referred to as horizon.

About 3000 Traffic Sensors in Paris



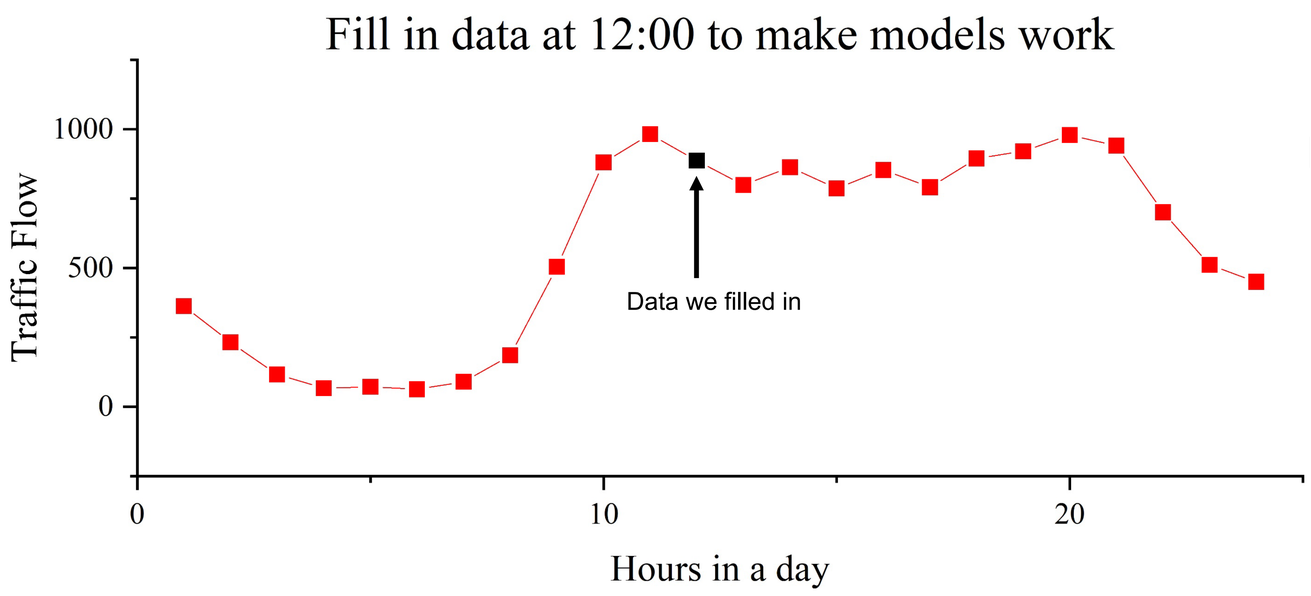
Task

Forecast the next-hour traffic every 30 hours in 2023 for 1757 sensors, given the 24-hours' traffic flow before each prediction and the data recorded by all valid sensors in 2022.

Challenges

Incomplete data: Some data points are *missing*, even in the 24-hours' lookback windows in 2023 which are directly served for prediction.

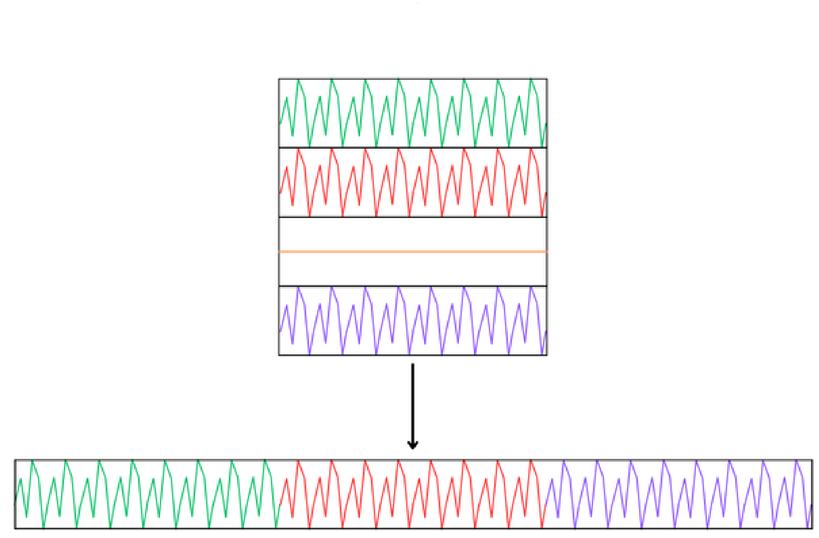
In the following example, the traffic flow at 12:00 is not provided. We must manage to fill it in.

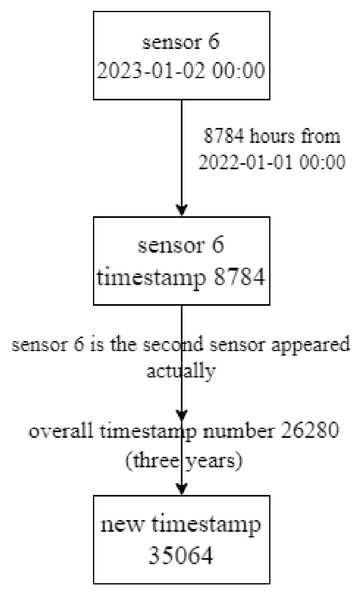


Our Approach

Data processing

- Use the average value of data from *integral* weeks ago to fill in gaps within data.
- Eliminate invalid sensors (data not provided, or outputs zero constantly), then flatten data from all sensors.

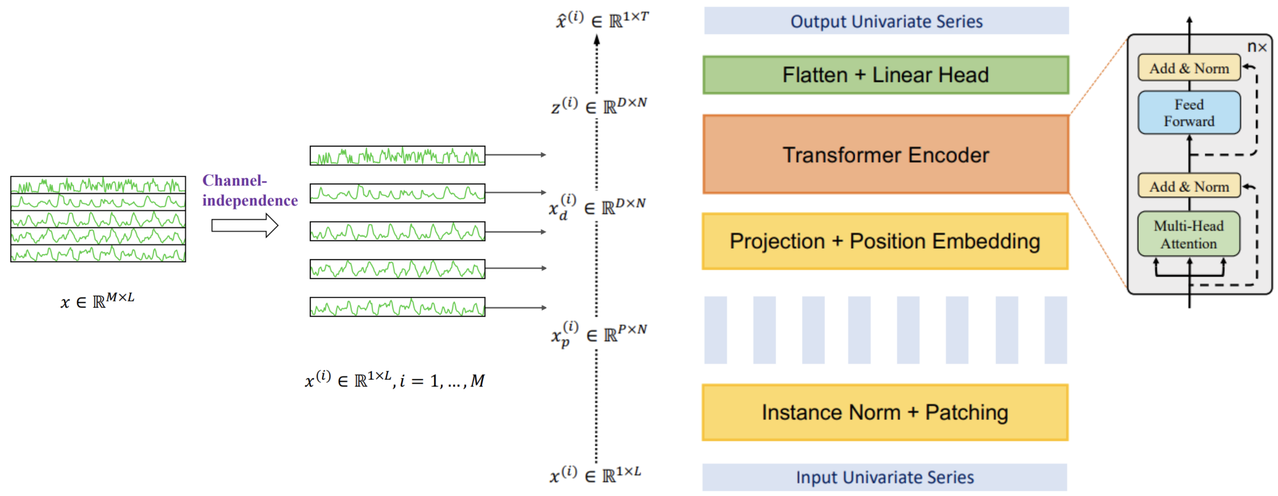




PatchTST model

Features channel independence, but ignored by flattening data

Improves learning of trends throughout the city



Experiments

Setup

Dataset: https://www.kaggle.com/competitions/paris-city-brain-traffic-flow-forecasting/data

Metrics:

Provided by grading scripts on Kaggle

Received 72.34 points (minimal score means optimal) eventually

Compared Models

- **DLinear**: Moving average kernel to decompose data → 2 simple linear model for temporal & seasonal components respectively
- **NLinear**: Subtracts each input sequence by its last value → a simple linear model → add it back
- **RLinear**: (R stands for RevIN, a simple invertible normalization function) Normalize → linear model → Denormalize

Results

Models	Metrics
PatchTST	72.34267
NLinear	86.21393
DLinear	88.27942
RLinear	102.2922