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Bikelytics: Spatio-Temporal Analysis of Bike Trip Data

Bikelytics is an interactive dashboard that visualizes the trip data recorded by the bike-sharing service to help discover patterns in the ridership trends and even identify potential areas of improvement by analyzing how the flow of riders varies over time between any stations or regions of interest. By considering factors such as the seasonality, weather, the rider behavior at any station, demographics, and the overall connectivity of any region, we aim to provide actionable insights to the service operators to take measures in scaling and optimizing the service and addressing any bottlenecks that impact the flow of riders. We aim to help the companies plying and operating bikes to monitor the usage of their bike services across the city so as to effectively tune their operations based on the usage. For this project, we will be using the trip history dataset obtained from Chicago's Divvy Bike website, which is published on a monthly basis by the operator, and the hourly weather trend obtained from the city administration's official government website. Both these datasets are at rest and Spatio-temporal in nature. The system uncovers valuable information from the data using sophisticated processing techniques for data visualization.

Bikelytics, as a web application, employs a client-server architecture with MVC (Model, View, Controller) design pattern, wherein the user interacts with the views to control what data the model will return to create a new/updated view. There are 3 main interactive views: dashboard, user’s page, and station page. Using data-viz libraries like AMCharts, Plotly.js and Flowmap.Blue, scatter maps, heat maps, flow maps, bar charts, and more visualizations are implemented. To make user experience smooth, charts update whenever new data is added or when another chart is interacted with. Overall, the following interaction mechanisms have been incorporated throughout the application: Dragging, Hovering, Zooming, Vertex Selection, Edge Selection, Linking of different views, Brushing, Sliders, and Labeling.

The application helps in determining how the bike-sharing system is performing. It shows the user the strongly and weekly connected regions in the city, and the overall flow between the regions. Along with route-wise analysis, an operator would also be able to view the most and least popular routes taken. If at all any bottleneck occurs in the system, it’ll help the operator to manage the situation in a better way next time it happens. Basic rider demographic information and trends are also displayed. The weather trends combined with ride trends tell the operator when the customers prefer to take the bikes.

The views in the application summarize the a high-level picture of the service, that includes its overall performance and trends, describe the flow between regions and stations, and inspect any station to determine whether it meets the expected performance or if there are any potential bottlenecks. It also is built in a way that with some pre-processing, most of the charts can be reused with any other bike-sharing system of other popular cities with ease. Eventually, this analysis can be used along with ride data analysis of other modes of transports to see the different trends of transportation in the city.

The project presents a comprehensive analysis of the different patterns of bike sharing systems which can be utilized by the bike operators to tune their system to attract more users and increase their revenue. For example, implementing seasonal summer plans or increasing the number of bikes available on a busy day can be done from the data analysed.