Part 1: Network Analysis Deep Dive

Stakeholder Network Needs

- **Restaurant Managers:** Want to know which vehicles are most efficient for different types of orders.
- **Delivery Drivers:** Need insights into traffic conditions and their effect on delivery time.
- **Customers:** Would benefit from understanding expected delivery times based on weather and traffic.
- **Logistics Team:** Can optimize fleet allocation based on vehicle type and traffic conditions.

How Networks Help Stakeholders

- Networks allow us to see connections between different aspects like food type and vehicle type.
- They help understand how weather and traffic impact delivery time.
- This helps stakeholders make better decisions for optimizing deliveries.

How Networks Help Users Gain Insights

- Helps in identifying the best vehicle for each type of food order.
- Shows how traffic & weather conditions impact delivery times.
- Helps in route optimization for better efficiency.
- Reduces delivery delays by understanding problem areas.

Data Assessment

Type of Network Represented

- The first visualization (Food Type to Vehicle) is a tree network that shows which vehicle type is used for different food types.
- The second visualization (Weather & Traffic to Time Taken) is a hierarchical network that shows how weather and traffic impact delivery time.

Nodes & Variables

- Nodes represent different elements like food types, vehicle types, weather conditions, and traffic conditions.
- Edges (Connections) represent relationships between these elements (e.g., food type to vehicle, weather to delivery time).
- Edge Weight represents the count of orders or average delivery time.

Relationships Between Nodes

- **Food Type → Vehicle**: Shows which vehicle is used for which type of food.
- **Weather Conditions → Traffic Density**: Shows how weather impacts traffic.
- **Traffic Density → Average Time Taken**: Shows how traffic delays affect delivery time.

Data Representation

- The dataset is in a structured format (CSV/Excel).
- Relationships are mapped as edges between nodes.
- Numerical data (like time taken) is aggregated to show average values.

Network Metrics for Users

- Most used vehicle for each food type.
- Longest delivery times under different conditions.
- Which weather conditions cause the most traffic jams.

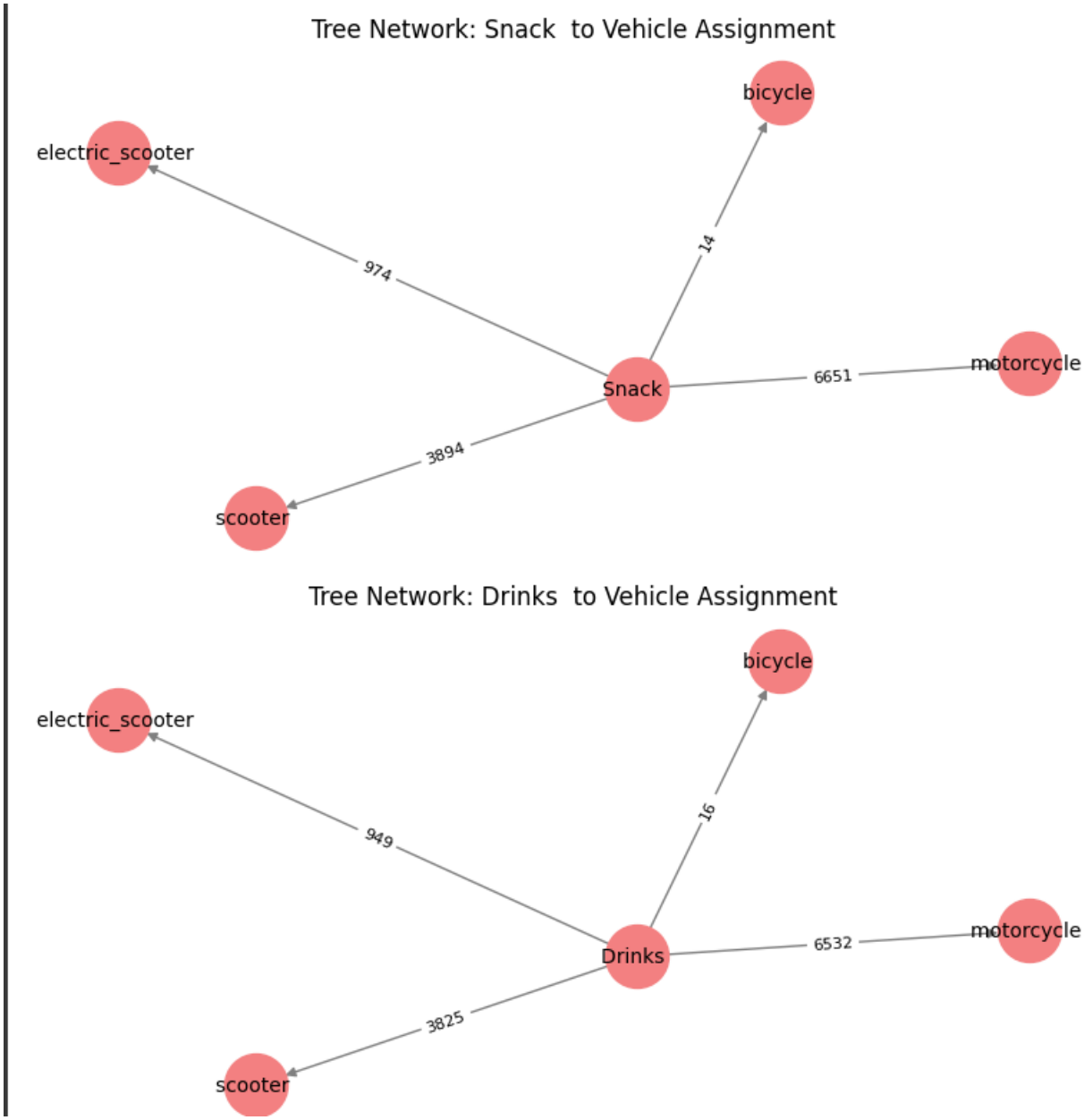
How Network Data Connects to the Project

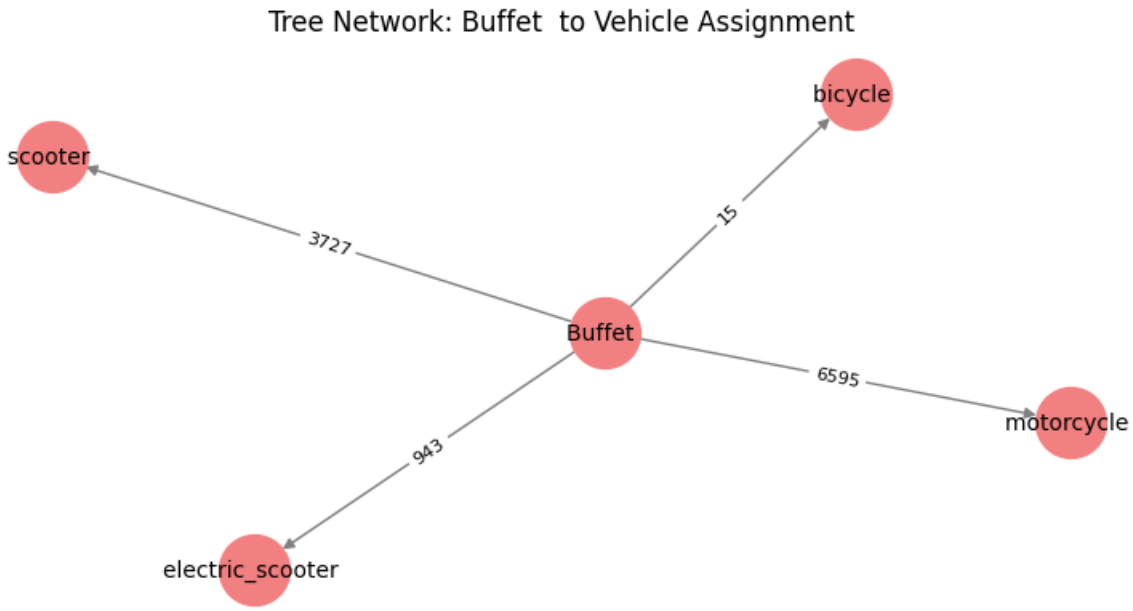
- It provides insights into delivery efficiency.
- Helps in optimizing logistics and reducing delays.
- Can be used for real-time decision-making to improve ETAs.

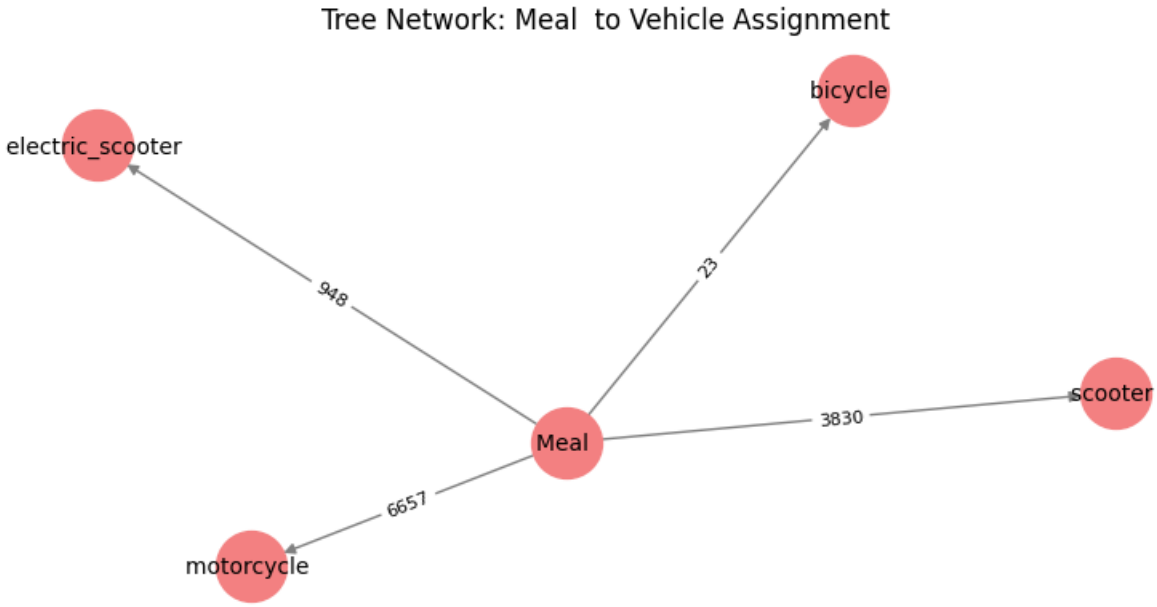
Initial Design Exploration

Visualization 1: Tree Network for Food Type & Vehicle

- Why? It shows which vehicles are used for which food orders.
- Key Insight: Helps optimize vehicle selection based on food type.

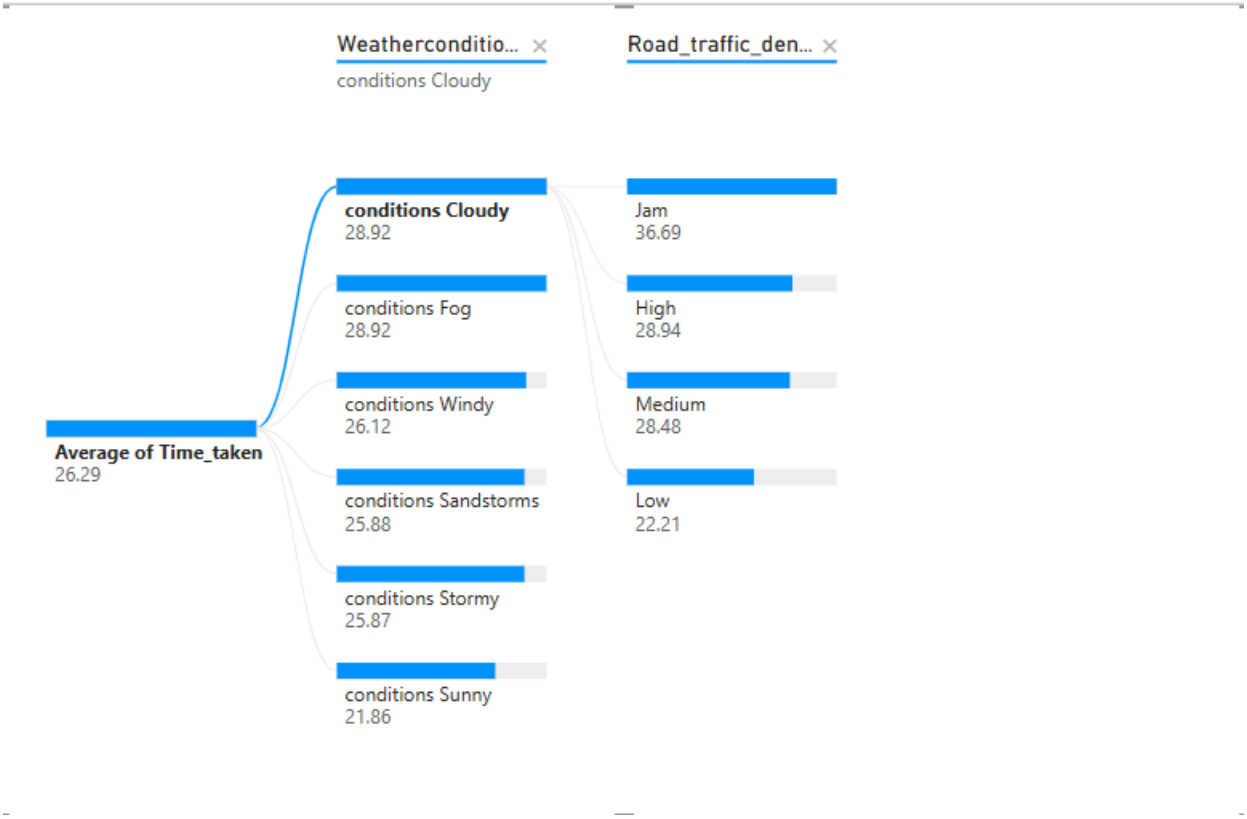






Visualization 2: Weather, Traffic & Delivery Time

- **Why?** It shows how different factors impact delivery performance.
- **Key Insight:** Helps understand which conditions cause delays.



How Network Patterns Connect to Other Data

- Food type connects to vehicles used for delivery.
- Weather connects to traffic conditions.
- Traffic conditions connect to delivery time.

Sketching & Documenting the Design

- The first network visualization was designed to help delivery managers understand vehicle usage.
- The second visualization was structured as a decision tree for easy analysis of delays.
- The data was cleaned to remove missing values (NaN) before visualization.

Part 2: AI-Assisted Design Process

Document Your Interactions

- **AI Model Used**: ChatGPT (Version: GPT-4o)
- **Prompts Used**:
    1. *"Give me a tree visualization that shows food type and the vehicle used for delivery."*
    2. *"Suggest a way to make the visualization less cluttered."*
    3. *"How can I group my data for better insights?"*

Why These Prompts Were Used?

- I wanted to explore different network/tree visualizations.
- I needed suggestions on reducing clutter and improving clarity.
- I wanted to understand how to clean and structure the data before visualization.

Implementation Plan

Why Were These Tools/Libraries Selected?

- **Python (NetworkX, Matplotlib)** → For creating network graphs and trees.
- **Power BI** → For hierarchical tree visualization with interactive filtering.
- **Pandas** → For data cleaning and preparation.

What Interactive Features Might Be Helpful?

- **Filters**: Ability to filter by weather conditions, traffic levels, and food type.
- **Hover Information**: Showing exact delivery times when hovering over nodes.
- **Drill Down**: Clicking on a weather condition to see how it affects different types of food.

Data Preparation Steps

1. **Remove missing values** (*NaN in weather conditions*).
2. **Group data** by **weather, traffic, and food type**.
3. **Calculate average delivery time** for each group.
4. **Format data properly** so it can be used in visualizations.

Data Analysis & Visualization Tools

- **Matplotlib** → For network graphs.
- **NetworkX** → To create tree-like structures.
- **Power BI** → For interactive filtering.
- **Pandas** → For aggregating and preparing the dataset.

How Will Data Quality Issues Be Handled?

- Dropping NaN values where necessary.
- Ensuring consistency in categorical values (e.g., "Sunny" vs "sunny").
- Handling outliers in delivery times by setting a reasonable range.

Evaluate AI Suggestions

Which AI Suggestions Were Helpful?

- **Recommending NetworkX for Python-based network graphs** → Useful for showing relationships clearly.
- **Suggesting node size adjustments to reduce clutter** → Made graphs more readable.

What Limitations Did You Encounter?

- AI suggested a chord diagram, but it was difficult to implement due to JSON serialization errors.
- Some AI-generated plots were too cluttered, requiring manual adjustments.

How Were AI Suggestions Modified?

- Instead of a cluttered chord diagram, I used tree networks.
- Grouped data before visualization, instead of plotting raw data.
- Filtered out low-impact conditions to avoid unnecessary complexity.

What Visualization Best Practices Did AI Miss?

- AI did not automatically suggest interactive features like filters and drill-downs.
- It didn’t consider color accessibility (needed to adjust for colorblind users).
- AI didn’t focus on labeling improvements—some labels overlapped, so I manually adjusted them.

How Did You Fix These Issues?

- Manually adjusted node sizes and spacing.
- Added interactive filtering in Power BI.
- Refined data groupings for clarity.