CSCE 5320 Scientific Data Visualization

Project Proposal: Global Electronics Sales & Marketing Impact

1. Project Title

Global Electronics Sales & Marketing Impact: Analyzing ROI and Regional Performance

2. Project Overview

This project will investigate the relationship between marketing campaigns and sales performance for a global electronics retailer to identify which campaigns drive the highest return on investment (ROI) across different countries and product categories.

The Problem You Are Solving:

Companies struggle to effectively allocate marketing spend and measure its true impact across diverse, global markets. The goal is to solve this by providing clear, data-driven insights and an interactive platform to help marketing and sales teams optimize their strategies, ensuring resources are directed toward the most effective campaigns and regions. The visualization will answer key questions such as: *Which marketing channels (e.g., social media, print, digital ads) deliver the highest sales lift per dollar spent?* and *How does marketing effectiveness vary geographically and seasonally?*

Dataset Selection:

We will use a primary **Retail Sales Dataset** (which includes sales revenue, product category, region/country, and time of sale) and a secondary **Marketing Campaign Dataset** (which includes advertising spend, campaign type, and target region/product). The combined dataset will be large enough to support meaningful analysis and complex correlation detection across temporal, categorical, and geographical dimensions.

Tools and Technologies:

Both projects will leverage different tools/technologies to demonstrate a progression from basic to advanced visualization techniques.

- **Project 1 (Exploration & Basic Visualization): Tableau** or **Power BI** will be used for initial data exploration, cleaning, and creating basic static visualizations to detect initial correlations and trends.
- **Project 2 (Advanced Analysis & Interactive Visualization): Python** libraries, specifically **Plotly** and **Altair**, will be employed for advanced correlation analysis, merging the two datasets, and building the final interactive webpage for dynamic data exploration, thereby demonstrating skills in custom web visualization development.

3. Objectives

The project is broken into two distinct, but linked, phases. Project 2 will build directly upon the foundation and insights established in Project 1, differentiating itself through the use of an additional dataset and advanced visualization technologies.

Project 1: Data Exploration and Initial Insights (Tableau/Power BI)

- **Data Understanding & Transformation:** To explore and understand the structure of the primary Retail Sales Dataset, including cleaning, handling missing values, and transforming date/time data to allow for effective trend analysis.
- **Trend Identification:** To create basic static visualizations (e.g., bar charts for regional comparison, line charts for monthly/quarterly trends) to identify high-level sales performance by product category, region, and time.
- **Initial Correlation Analysis:** To perform initial correlation analysis within the sales data (e.g., how sales revenue correlates with product category or time of year) and summarize key findings.

Project 2: Advanced Analysis and Interactive Visualization (Python/Plotly/Altair)

- **Deeper Data Integration:** To merge the primary Retail Sales Dataset with the secondary Marketing Campaign Dataset to gain deeper, cross-dataset insights.
- **Complex Correlation & ROI Quantification:** To perform complex correlation analysis to quantify the impact of specific marketing campaign types (using the Marketing Campaign Dataset) on sales revenue and calculate the Return on Investment (ROI) per region.
- **Interactive Web Visualization:** To create advanced, interactive visualizations (e.g., a choropleth map for regional ROI, dynamic scatter plots for spend vs. revenue) and deploy them on a working webpage that allows a user to dynamically filter and explore the ROI of various marketing campaigns by country, product, and campaign type.

4. Tools and Technologies

Project Phase	Tool/Technology	Rationale
Project 1	Tableau or Power BI	Superior tools for rapid data exploration, cleaning, filtering, and generating preliminary, high-level, and static visual dashboards.
Project 2	Python (Plotly & Altair)	Essential for advanced data manipulation (merging, complex calculations like ROI) and for creating custom, interactive web-based visualizations, which is the core deliverable.

5. Dataset Selection

We commit to using a minimum of two relevant and sufficiently large datasets, ensuring the methodology is linked between the projects.

- **Dataset 1 (Project 1 & 2): Retail Sales Dataset:** This will be the foundational dataset, containing historical transactional data, including **Sales Revenue**, **Product Category**, **Region/Country**, and **Date/Time** of sale.
- **Dataset 2 (Project 2 Only): Marketing Campaign Dataset:** This dataset will be added in Project 2 for deeper analysis, containing data on advertising expenditure and campaign execution, including **Marketing Spend**, **Campaign ID**, **Campaign Type**, **Target Region**, and **Duration**.
- **Sources:** We will utilize public, large-scale datasets focused on global retail or electronics sales, sourced from platforms like Kaggle or similar public repositories.

6. Methodology and Storytelling Stages

The project will follow a four-stage storytelling framework, guiding the user from initial data understanding to interactive, actionable insights for optimal marketing strategy.

Project 1: Data Exploration and Initial Insights

- **Stage 1: Data Understanding and Exploration (Weeks 1-2 Focus)**:
  - **Storytelling Focus:** *Setting the Scene*. Introduce the problem and the primary Retail Sales Dataset. The story will begin with a basic exploration of sales figures over time and across major product categories and regions to establish the overall performance landscape. Key visualizations will include time series plots and simple category bar charts.
- **Stage 2: Data Processing and Correlation Analysis (Weeks 3-4 Focus)**:
  - **Storytelling Focus:** *Uncovering the Status Quo*. The narrative moves to processing the data (e.g., normalizing sales data) and uncovering initial relationships. We will use Tableau/Power BI to visualize correlations between factors like regional performance variations and seasonality of sales by product (e.g., identifying Q4 peaks for high-margin electronics). This stage concludes Project 1.

Project 2: Advanced Data Analysis and Interactive Visualizations

- **Stage 3: Adding More Datasets and Deeper Analysis (Weeks 5-6 Focus)**:
  - **Storytelling Focus:** *Quantifying the Impact*. The story deepens by merging the Marketing Campaign Dataset with the sales data. We will perform advanced analysis using Python to calculate and visualize the precise Return on Investment (ROI) for different campaign types, uncovering patterns that quantify marketing effectiveness, which were not visible in the sales data alone.
- **Stage 4: Advanced Visualizations and Communication (Weeks 7-8 Focus)**:
  - **Storytelling Focus:** *Actionable Strategy*. The final stage crafts a compelling, interactive narrative centered on actionable insights. This involves developing an

interactive webpage featuring visualizations like a dynamic heat map showing campaign ROI by country. The design will allow the audience to dynamically explore the campaign ROI story by filtering, drilling down, and visualizing the key recommendations. This stage includes final integration and deployment.

7. Interactive Webpage and Storytelling Rule (Project 2)

The interactive webpage will be the ultimate deliverable for Project 2 and will be structured for optimal communication and self-exploration.

- **Main Page (High-Level Summary):** This page will serve as the executive summary, introducing the project, the business problem, and the high-level conclusions:
  - A headline metric (e.g., Overall Marketing ROI).
  - A summary of Project 1's key findings (Top 3 Selling Products, Top 3 Regions).
  - A clear statement of the final recommendation (Highest ROI Campaign Type).
- **Inner Pages (Detailed, Interactive Experience):** These pages will house the advanced visualizations, allowing the user to dive into the data:
  - **ROI Deep Dive Page:** Featuring dynamic scatter plots (Spend vs. Revenue) and a dedicated choropleth map where users can select a campaign type and instantly see the ROI performance across the globe.
  - **Product Performance Page:** Showing the specific sales lift attributed to marketing by product category, allowing users to select a region to filter the view. The interactive nature will be central to the storytelling, allowing users to validate the final recommendations.

8. Timeline (8 Weeks)

Phase	Weeks	Activities/Deliverables
Project 1	**1-2**	Data Acquisition, Cleaning (Sales Dataset), Initial Tableau/Power BI setup, and basic static visualizations (Trends, Seasonality).
	3-4	Initial sales correlation analysis, summarize correlations, and finalize Project 1 Report/Summary. **(Project 1 Conclusion)**
Project 2	**5-6**	Data Acquisition (Marketing Dataset), data merging,

		and complex ROI calculation using Python/Pandas. Develop initial interactive visualization wireframes.
	7-8	Develop and finalize advanced interactive visualizations (Choropleth Maps, Dynamic Charts) using Plotly/Altair. Build, integrate, and deploy the final interactive webpage. **(Project 2 Conclusion)**

9. Deliverables

- **Project 1:** Initial static visualizations, the fully transformed and cleaned Retail Sales Dataset, and a report on the basic correlation analysis and high-level insights.
- **Project 2:** The combined, analyzed dataset (Sales + Marketing), a report detailing the advanced ROI correlation analysis, all source code for the interactive visualizations, and a working interactive webpage.

-Team Members

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