templateSample Paper Title

WU Zhiwei XU Xiaohan Cai hairui Liu ran

Computer Science Engineering Department

Hong Kong University of Science and Technology, Hong Kong

Abstract

Import trade is an important part of national development concerns. How to visualize as comprehensive information as possible in a visualization project is a very valuable task. Thus, we present the ImportNetwork to provide users a overall view, including the value, trend and transport etc. Besides, users can get the corresponding information through different time and place of the mouse. A case study is conducted to demonstrate its usefulness.

**Keywords**: Radiosity, global illumination, constant time.

# Introduction

## Background

In recent years, research has shown that imported goods can have multiple effects on a country. For example, food import generally improve nutritional, health and demographic outcomes[1]. And it will affect the prices of related products in the entrance area and even the regional economy[2]. Besides, protective import tariffs generally lead to economic-environmental trade-offs. Therefore, research on imported goods is particularly important. In this project, we combined the characteristics and types of data to design a complete and comprehensive visualization project. The inner relationship in the Border Crossing Entry Data of United States can be displayed intuitively.

## Data

The Border Crossing Entry data set we used is from Kaggle.com [3]. The Border Crossing Entry data set takes 35M of memory size and contains 346734 listing data samples with 8 columns, which spans from 1996 to 2019. These columns in the data set including Port Name, State, Border, Measures, Value, etc. The data set contains many different type of data, including integer, float, string, date, list, etc.

## Contributions

This project is therefore proposed for more comprehensive visual analysis of Border Crossing Entry. Specifically, we designed a fully functional system, which shows the changes in the value of imported goods on each states over the years and the relationship between the states and ports that import goods in different years. Our contributions could be summarized as follows:

• A new interactive visual design for Border Crossing Entry analysis, the information displayed by which will change according to the user's hover point. Users can see the change of data very intuitively.

• A comprehensive understanding of the Border Crossing Entry. Our system can not only show the value of imported goods, the port of goods, the mode of transportation of continents over time, but also compare and display data between different continents.

# Related work

First of all, we did the data cleaning and worked on Feature Engineering. Data processing is one of the most important jobs before the visualization of data. We had spared no effort to finish this step. We used a full range of feature engineering to process the data set, including but not limited to the selection of data columns and multiple encoding methods of data columns. Secondly, we designed our project by reviewing the content in class and draw lessons from the methods of excellent visualization projects over the years.

## Feature Engineering

### Drop Useless Columns

We removed two columns: Port\_Code, Location. There is a one-to-one correspondence between the Port\_Name and the Port\_Code. Considering that we need to show the name of the Port in the visualization project, we dropped the column of the gateway number. In addition, the Location shows the latitude and longitude of each state in the United States. In the coding of this project, we use D3 to display the various continents in the United States. We don't need to code the latitude and longitude, so we dropped this column out.

### Normalize

Due to the large time span of our data set, accurate date display is meaningless and not feasible. So we convert the date in the A column of the dataset into a year. In the following visualization process, we will show the Border Crossing Entry data of the US according to the year.

## Feature Encoding

For the Measure whose feature values do not have an ordered relationship, we use one-hot encoding to construct a vector with the same size with the number of unique value in these columns.

# Design goals

Import trade has become an important factor affecting the economic and political aspects of a country. From a lot of research literature on import trade, we find that the main concerns are as follows:

### T1: For a given state, where are the goods imported from? By studying the continents and the ports from which the cargo originates, we can grasp the distribution of ports connecting to a certain continent.

### T2: How total value of imported goods changed by state over time. Another task of this project is to visually show the changes in the value of imported goods on different continents, includes the geographical location and the comparison between different states, etc.

### T3: How are goods imported? What percentage of each method? Visually showing the import methods and proportion of imported goods by each methods is also a very meaningful design for this project.

# Visualization design

We propose to build a visual system, ImportNetwork, to complete these tasks mentioned in Section 3. Our ImportNetwork contains four views. The Stacked View intuitively visualizes the changes in the import volume of the states with larger imports over time. The Map View directly shows the distribution of the value of import on the map. Measure Statistics View, which serves as an assistive view for analyze the method and proportion of them. The last is a Sankey View, which vividly shows the relationship between imported ports and destination states. The rationales we follow and the concrete designs for the four views and the embedded interactions are introduced below.

## Design Rationale

Based on task analysis, we have compiled the following design rationales:

### R1: Show the value and trends. As a research on network analysis of imported goods, we need to first determine and present the quantity of goods and the changes over time.

### R2: Present the relationship of ports and destination. According to the T1, for a continent, our project needs to show the origin of the goods.

### R3: Interactive and intuitive. The system we design needs to provide user interaction, not just a single graph which shows statistical values. And on this basis, use appropriate coding methods and diagram types to display different types of data to improve the intuitiveness of the project.

## Network View



1. Two boxes. One filled with confetti.

Based on task analysis, we have compiled the following design rationales:

# Evaluation

Through our ImportNetwork which shows the import information, we summarized our findings below.

First of all, in the overview (Fig. 1), we notice that we found that A、B and C imported goods from 1996 to 2019 always ranked in the top 5 in all cities. Although the import volume of some states changed significantly, such as A, but their proportion in the total import volume is still relatively small.

Besides them,

During browsing, we further find that

# Conclusion

In this paper, we propose ImportNetwork, an interactive and intuitive visual system to help users understand the overall import information. We summarized the tasks and principles of project design, and design 4 views to comprehensively display import information from different aspects and latitudes. The case study exemplifies the effectiveness and the usefulness of our project design.

ImportNetwork still has room to improve. A primal improvement needed is to display import information for most states. It can be found in our project that most of the data in the data set are coastal cities, and the data in inland areas are missing, which has affected the completeness of the visualization of the entire project to some extent. Thus, we should find a more complete dataset for our project. Besides, in addition to mining the inherent relationships of the data, we can spread our concerns to other aspects. For example, local economic level, import tax, etc. But this requires more professional knowledge and analysis, which may take a long time to learn.

References

1. Henning Tarp Jensen,Marcus R. Keogh-Brown,Bhavani Shankar,Wichai Aekplakorn,Sanjay Basu,Soledad Cuevas,Alan D. Dangour,Shabbir H. Gheewala,Rosemary Green,Edward Joy,Nipa Rojroongwasinkul,Nalitra Thaiprasert,Richard D. Smith. International trade, dietary change, and cardiovascular disease health outcomes: Import tariff reform using an integrated macroeconomic, environmental and health modelling framework for Thailand[J]. SSM - Population Health,2019,9.
2. Maria Bas,Vanessa Strauss-Kahn. Input-trade liberalization, export prices and quality upgrading[J]. Journal of International Economics,2015,95(2).
3. Akhil. Border Crossing Entry Data, 2019.

https://www.kaggle.com/akhilv11/border-crossing-entry-data

1. Imports of Certain Worsted Wool Fabric: Implementation of Tariff Rate Quota Established Under Title V of the Trade and Development Act of 2000: Removal of Regulations[J]. The Federal Register / FIND,2019,84(136).