Sneakers Tracker: Sneakers Price Tracker with StockX Data

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Abstract

Sneakers now are one of the most powerful ingredients of the fashion industry, and it is not just meant about newly produced. Sneakers released years ago have become a trend of shoe collecting culture. They are no longer planned made by certain companies like Nike or Adidas, and the price of second-hand items is surging to very high. Sneakers Tracker focuses on those users who collect unique sneakers, involve in reselling business and are interested in those special sneakers. This web app maintains the simplicity of operating any features and is easy to read for those contents so that anyone who uses this application can quickly adapt. Unlike there are numerous websites selling sneakers, no web application offers specific information as a user of sneakers culture. Therefore, Sneakers Tracker aims to display demanded information to view the price trend of individual items in each brand, model, and size, to compare two products for easier decision-making, and to explore unknown factors that are related to sneakers prices.

Introduction

Visualization offers an excellent method for better understanding to audiences as they can view the information than not just reading. However, visualization often misleads the direction of facts. That is why information visualization has an essential role in data analysis, considering the effort to allow correct details to users. According to Tamara(2014), information visualization "is concerned with situations where the use of space in a visual encoding is chosen by the designer"(p. 29). Therefore, those selected graphs or tables can create a correct notion about contents and topics.

While the shoe industry is expanding, collecting or reselling specific footwear types has become a trend and is now called sneaker culture. Yet, those websites from shoe companies or marketplaces do not consider the users in this sneaker culture. Because those websites focus on selling their products or a few popular items, it is not easily catchable trends in different shoes. Indeed, platforms offering prices and trends are required for those who want an insight into sneakers at one sight instead of travelling all other web pages and opening multiple windows. Not only the intensive fans of sneakers but also those people who are in the gray area with a bit of interest and want to spend less money also need to be counted.

With Sneakers Tracker, users can obtain general and deeper information about many shoes. For those who have little knowledge about collecting popular sneakers, graphs of 50 different shoes that are more than 950 sneakers in various sizes, will indicate which ones are the most or least expensive as well as their trends using volatility rate. Also, depending on their choice of brands, models, and sizes, statistical summaries and graphs for individual shoes help users to get a brief idea of the increased amount and price trend.

For people who already have some interests and are willing to purchase sneakers, Sneakers Tracker allows them to compare the two different shoe side by side. They can see the prices, price trends, and some statistical information of two sneakers in one frame. That lets users gain direct details of their chosen sneakers.

For another group that wants to experience more profound facts and various figures, Sneakers Tracker offers users to explore the correlation between shoe sizes and the day those shoes tend to be sold. Also, geographical review within the US generates insight into regions that frequently buy and sell, which can be rephrased as the available to observe certain states where sneaker collecting is more popular.

Acquisition of the correct information leads to making the right choice. As this web application offers various details for different types of consumers, they can decide what to buy, when to sell, or even where to get, so they

can be smart consumers while purchasing worthy sneakers. In addition, users can obtain fun facts like which sizes are selling more on which days.

Why Sneakers Tracker?

Sneaker Culture may not be very familiar to people who care lesser about the fashion industry. As Cillizza(2022) stated, the development of the internet -- and in particular sites like eBay -- changed all that. Suddenly, older versions of shoes could be purchased -- and collected. And sneaker companies, Nike especially, leaned into the trend (para. 14). The sneaker-collecting phenomenon is yet only for small communities' trend, but it is ongoing to spread out to others. That is because more celebrities on tv or online brag about their limited-edition sneakers, then the public is influenced. The price of sneakers unexpectedly surges often when a celebrity like a rapper or a movie star wears that. That means sneakers are like any other fashionable items; generally, people are affected by whom they want to follow.

Sneaker collectors keep their eyes on popular items when the renewed or unique items are rereleased or show up on the marketplaces. When big companies like Nike announce their products, collectors set their schedule to be ready for the open run to wait in line to get into the store before they open. Depending on its popularity, more than 12 hours of waiting time is required to purchase the product they want. For the sneakers that will never reproduce again, when they appear on the market, they are put into the auction, and their bids go up high, which explains how sneaker collecting can be an investment for some people. Professional resellers buy valuable sneakers when they are released initially or when the second-hand product's price goes down than usual, then sell them. As its demand is high within the limited supply, the price gap between buying and selling is high enough to make money, so collecting sneakers can be someone's job. That is, it is worth jumping into this business. Hence, people who have yet to be aware of this area have started to get interested in collecting unique sneakers. And now, this wave demands a platform that combines different shoes and their information.

Since this is quite a new field, there are multiple types of requirements, and therefore, the web app needs to be simple and easy to understand while offering detailed knowledge about sneakers. Unfortunately, websites from companies such as Nike or Adidas only list new products, making buying a collectable shoe challenge. Moreover, most shoes worth purchasing are sold out most of the time, which raises questions about which ones are more competitive to collect or what are their price expectations. Therefore, users who want to check a list of valuable products are unable to look into it. Of course, there are existing online marketplaces like StockX or GOAT that have provided price trends since the time sneakers first come out. However, those places demonstrate those visualizations in a too complicated way. That is, only once a user clicks one shoe, and scrolls down to the bottom can the historical graphs and statistics be seen. These data may be accurate, yet they only show the clicked sneakers. It is a good option for people who already know what to purchase, but it is not helpful for people who are new to this culture.

Thus, it is necessary to have an application that is able to see the price of multiple items, gain price ranges of each item, and compare different sneakers. This way, whoever looks to get into this culture or who already knows but requires all details in one place can gather the necessary information. Then it lowers the wall for newbies, resulting in more people involved in this industry. This application can help those companies that want to prohibit massive price increases for a specific item. For example, as this platform offers top-to-bottom peak prices for each item, companies that don't want the price increases can produce more for those items. Sneakers Tracker can be a good material for any user on both ends.

Design – what

Sneakers Tracker aims to offer a dashboard that contains multiple features in one view. That is, statistical data and graphs chosen by filters are allowed to be seen on one single page. Also, it enables the user to compare two items in another tab. In addition, users can explore extra information regarding sneakers using heatmap and choropleth

map view. With dark green as the primary theme colour, different shade levels are applied to highlight features like buttons. Moreover, the white background makes users focus on the information they are willing to obtain.

The frame of the main page is divided into three parts, a bar chart, statistic summary boxes, and small line graphs. The main attributes of this web application are bar and line charts in multiple views. Multiple views allow users to approach overview and detailed information with multiform views. Within multiform, two different graph type shares the same data. The bar graph demonstrates the result from the entire dataset, and the subset based on the user's choice is shown in the line graphs. The line graphs are a version of the price trend of individual sneakers. The line chart follows the small multiples method depending on the search result. Using small multiples, the Sneakers Tracker can access the partitioned price data of each item with small pictures of sneakers for the user's understanding. On the left side of the main frame, four little boxes are located for statistical values, such as the number of sneakers, volatility, retail price, and the gap between retail price and peak price. Placing these boxes on the left side lets the user capture the brief information quickly, then move to the charts on the right side. These statistics summarize the data that is options applied. As additional design properties, dropdowns were selected. For the bar graph that reflects overall data, users can choose to see which type of information they want to get using dropdown options, price or volatility. Also, the users can select categorical data, such as brands, models, and sizes, to get subset data through dropdowns. Dropdowns here also subset the data themselves dynamically as the value of the first dropdown updates the second dropdown, and the second one updates the third dropdown. Therefore, our web application covers all types of users' purposes, from general searching to price trend information.

The second view contains two same features to compare two different sneakers. Its frame followed the format used on the main page. With two dropdowns to choose brands and models, when the user clicks the search button, the line graphs and statistical summary boxes will update. While maintaining the same feature side by side, a user does not get confused to read the results.

Another feature of our Sneakers Tracker web application is offering to explore and filter tasks for the user. This part presents two data visualizations: a choropleth map and a heatmap. As expected, both maps should follow a consistent colour palette not to overwhelm the user’s eyes. The intention of colour consistency meant that shades of green and white were utilized to stay true to the design intention of keeping the application simple and minimalistic. The frames encapsulating the two visualizations and the filters’ border-radius are also modified to keep edges consistent with the main page.

Dropdowns and checkboxes were used to update two visualizations on explore page. For the filters of a heatmap, a dropdown offers different brands to choose from, and checkboxes allow users to select various sizes. It is the most straightforward way to implement users' expectations vividly. Also, for the map view, dropdown filters sizes, and the map is highlighted by choice of sizes.

Design – why

Sneakers Tracker mainly looks for three types of users, collectors, resellers, and general buyers.

The collectors would focus on verifying specific items' price trends and comparing two sneakers they are interested in purchasing in the near future. They prefer to discover the best time to buy things that are already in their mind. For instance, a user will look for one shoe using dropdowns. One particular sneaker is updated in small line graph cards. They can observe their price trend and predict when will be the cheapest season to buy.

The resellers are the users who can use this tool the most proficiently. Although they aren't limited to any specific item, they are wide open to finding out things that are cheaper than usual or price trend goes high in the long-term view. Collectors would visit this web application to browse the items in general, then use dropdowns to narrow down the brands, models, and sizes they expected to purchase, then see the price trend demonstrated with line graphs. These people also could view explore tab to analyze the general preferences of shoe size and the most active regions of the business.

Lastly, general users would explore all three pages as per their usage. For instance, a regular user browses the bar graph representing all data to get a brief idea about which ones are the best or least. Also, they may search and look up the item they have seen in the bar graph using the dropdown and check the differences between models or sizes with line graphs and summarized information boxes. They are also able to compare from the compare tab. Here, they can compare two targeting sneakers and choose one from them, especially when they are limited financially. Another type of general user who wants to enjoy gathering information can check the explore tab, as this tab offers some exciting features.

Design – how

Figure 1: Tab Feature

The tab feature enables a user to move each page quickly, as Figure 1 shows. Once the user clicks another page, it functions to transfer to the page user clicked, then highlights where they are.

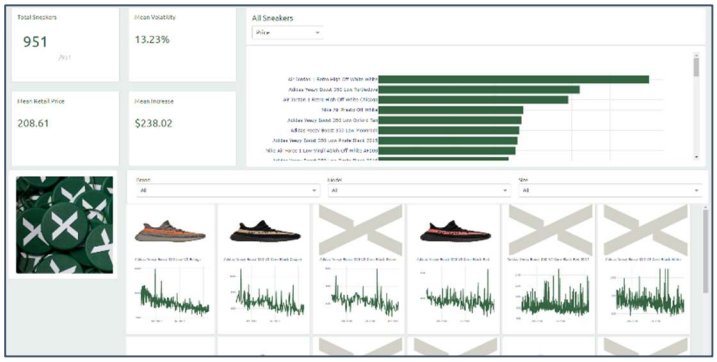

Figure 3: Main Page

In Figure 2, when entering the Sneakers Tracker first, the main page displays the values of the entire dataset. Also, the bar graph that is sorted by price is set as a default attribute. In four statistic boxes, values indicate a preview of all the data. 'All' are selected automatically for dropdown values. The order of small line graphs with sneakers images follows how the dataset is written. When the user manipulates filters, only the selected portion of data is reflected in the frame. Those four boxes show the number of sneakers in the searched range for total sneakers and mean values of volatility, retail price, and total gap of increase. The bar graph itself does not change as long as the same option is selected. If it changed to volatility, the bar graph would display the bar chart of volatility. The discrete sneakers information shows within the selected value from the dropdowns only.

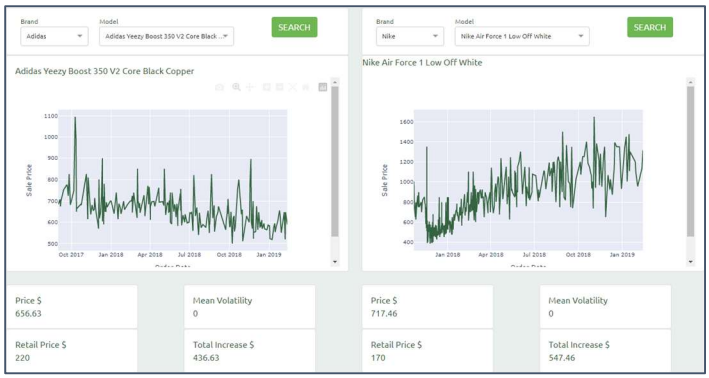

Figure 2: Compare Page

Sneakers Tracker provides another page in the second tab in case any user wants to compare the two sneakers in one sight. The format of the frame is a similar visualization as the main page shows up so that whoever uses this application for the first time does not need further training to read graphs and choose options. Also, the four rectangular give brief statistical information so that users can get an idea about which shoes suit them. The line graphs are visible per the user's choice from the dropdown.

The explore page, in Figure 4, consists of two data visualizations: on the left side, the user sees a heatmap describing the frequency of sneaker sales by day of the week. From the design perspective, users can filter what shoe sizes they want to see. The x-axis of the heatmap lists the day of the week, while the y-axis represents the shoe sizes the user wishes to see. A user also has the option to filter by brands between Yeezy's(Adidas) and Off-Whites(Nike) or both. The filter feature offers users more flexibility on what they want to see. This functionality or feature allows the scalability of the application. Lastly, the user is presented with a section of shoe size checkboxes in this data visualization.

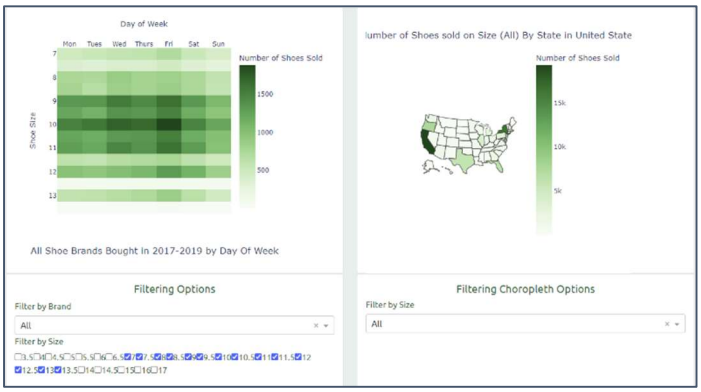

Figure 4: Explore Page

On the right side, the user sees a choropleth map that describes the frequency of sneaker sales by shoe size(s) in each state in the United States of America. This data visualization also allows the user to filter the shoe sales by shoe sizes, similar to how the user can filter out shoe sizes by using checkboxes. Giving such functionality of filtering allows consistency with the application. Consistent with the functionalities enhance the application's user-friendliness, which also brings in the familiarity of the app's usage.

Since our web app targets a wide range of users, we have focused on simplicity. The page is divided into fixed parts that make users recognize that the website is well-organized and easy to read. With this division, assigning different weights on each grid emphasizes more attention to the features in the frame. Also, maintaining the same visualization pattern on the main page and compare page minimizes the complexity of the user's experience. Another design principle applied here is combining white spaces and the same tone of colour, which also helps to keep the user's eyes on the key areas. Having the same colour palette encourages consistency throughout our application. The rule of whitespace requires greater attention to detail and should not be trivialized. According to Knaflic(2015), "white space in visual communication is as important as pauses in public speaking. That is the same powerful effect that white space used strategically can have on visual communications. White space can be used strategically to draw attention to the parts of the page that are not white space"(p. 84). Meanwhile, user interaction has been strengthened by adding several user choice filters.

Implementation

All data are offered or obtained from one of the most significant sneakers online marketplaces, StockX, which allows more datasets to be available. This project uses two datasets and API-driven data as primary data: StockX data contest, StockX Sneaker Data, and Unofficial StockX API. Three data set share similar attributes for five columns, with quantitative and categorical data, such as Brands, Name of shoes, Release Date, Sales Price, and Retail Price. However, StockX Sneaker Data and API-Driven Data have detailed attributes such as Lowest Ask, Number of Ask, Volatility, Deadstock, and Change Percentage. The majority of StockX Sneaker Data and API Driven Data is quantitative, relating to the price and number of sales of shoes. The majority of StockX Contest Data is categorical: Name, Brand, and Date. Also, we derived the average price of shoes by categorical values, such as name, brand, and date, as another attribute.

Although these datasets share some attributes, the format was written differently. For example, stockX contest data wrote the names of brands as Off-White and Yeezy for Nike and Adidas. However, another dataset was saved as Off-White, Nike Air, and Air Jordan for Nike and Yeezy and Adidas for Adidas products. So, for users unfamiliar with these rare brand names, they have combined Nike and Adidas. Also, the name of sneakers in the dataset from Kaggle was filled with a hyphen(-) for every space. It was removed to follow the rule of the name written in the other two datasets. One problem that drained the project time was one tiny space in Adidas's brand name. It was difficult to recognize as it did not look like there was a space, but it could be founded as it was troubled to search the name of brands. The issue from the searching brands was cleared once the space was removed.

As the primary language, Python was chosen as it allows to use of numerous libraries and countless collaborators who explain all the details of writing code. Python library "pandas" is used for analyzing and manipulating the datasets. It is a suitable tool as it offers fast and efficient data reading and flexible features like subsetting and group by. Numpy was considered to use in the calculation process, but basic python math functions like mean() or round() are enough to implement because Sneakers Tracker requires only simple calculations. A python module

that is used once, but is potent, is "os.path". Using this module, lines of if statements could be reduced to one line to find out if items in the dataset exist in the working folder.

Dash was great in use for the entire programming. It simplifies layouts and communications between features like dropdowns and graphs. One function that is used every time to connect components and data is the "callback" function. It enables them to assign values to the features while attempting the input value from the other elements.

Every chart in this web application is drawn using “plotly”, especially the “plotly express”. Plotly has many chart options like bar, line, choropleth, and heatmap. Moreover, it does make decorating charts easy.

Even though the functioning and purpose are close to a match as planned, some limitations exist in this project.

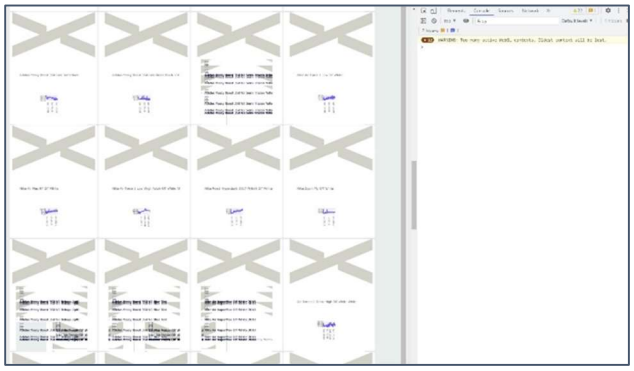

Figure 5: Plotly Error

Since StockX does not offer any official version of the application programming interface known as API, this project took one of the APIs that is not reliable. It caused to take too much time to scrape the information, so only Nike Jordan could grab our data use. Another problem with the dataset was that only a few sneakers models were overlapping between datasets. Consequently, many items in one dataset could not represent its volatility, which is unfortunate as the volatility rate can explain so much information in price trends. Any unavailable volatility is substituted as "Not available" or "0".

One unexpected problem was the "Too many active WebGL contexts" bug, as Figure 5 demonstrates. It happens since Chrome's WebGL context limit is 16. That means drawing more than 900 graphs on one page is unavailable when plotly used. There are many other suggestions, such as using subplots, SVG plots, or moving them to different pages. But these options were not suitable for planned design. For presenting the working project, graphs were limited to 20 to 25, but it produced some errors to work with other codes. It was a good lesson that choosing the proper method for planned design is very important.

Evaluation Methods

As this project's target group, the participants can be separated into three groups: collector, reseller, and general buyer. Since this application is meant to be built without training, the validation process can be started when users are ready. Although users suppose to have no issue playing with this application, assigning tasks can be sufficient to get validated results.

For the collectors, we can suggest looking at the compare tab to check the sneakers they like to purchase, then ask which features are given the most relevant knowledge and what do not help decide the item they would buy later.

For the reseller, we can specially ask them to work with the main page. Then surveys about the functioning and displaying of Sneakers Tracker, such as if all the dropdowns and checkboxes work without issues and if some graphs are too small to read information.

Lastly, those with little knowledge about sneakers culture can try all three pages. Then obtain their opinions on the outcome of each functionality, how easy to work with components, and if the given information is easy to understand.

Also, for the general purpose, we can get answers on the experiences regarding the time it takes to apply each feature to evaluate the algorithm complexity.

Conclusion

Since internet devices actively take place in our lives, some cultures have started spreading out. One of the waves quite recently added is sneakers culture. It represents people who love to collect limited-edition sneakers. From here, resellers came up to make this culture into their business. The price of those unique shoes fluctuates just like the stock market. So the resellers try to gain financial affluence using the gap between high and low prices. At the same time, sneaker culture has become widespread and popular, and newbies entered into this culture. These people do not have more profound knowledge regarding sneakers; hence, they look for searching the sneaker types which are worthy. Sneakers Tracker provides general to in-depth information for all different demands about sneakers. Sneakers Tracker offers features like price trends of various collections and peak prices recorded from top to bottom to fulfill the user's requirements. Also, it includes comparing sneakers, putting them next to each other, extra details about the relation between size and days, and the regional view where are most active in the shoe industry.

The application has been built with quite a proper function, yet limitations exist, which issue some errors in our application. Therefore, implementing a suitable data platform will be required for future work. Also, improvements like collecting more data and getting images dynamically can make this application reliable to publish.

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