**Final Project Summarization**

For my final project I wanted to analyze Honeybee data, including honey production and Neonic pesticide usage in the United States of America between the years of 1998 and 2017. In 1998 the USGS started collecting pesticide data as part of the Pesticide Nation Synthesis Project. All my data came from an awesome Kaggle repo that Dr. Baldwin shared with us previously. The dataset contains a lot of data that I did not integrate due to myself not wanting to overcrowd the project, and restrictions in Shiny. I started my mini-project by analyzing the data during the whole entire date range. During the range there was a lot of neat graphics I was able to develop using Berinato, Tufte, and Kosslyn’s principles. For my final project I wanted to refine these graphs and take the data to the next level. I was able to achieve everything I have done so far by adding a few new features during the creation of a Shiny application.

I have a lot of experience creating web applications and this fell into that category somewhat. Ultimately, I do not find Shiny as a viable form of creating a web app, but it is nice that it allows for easy integration of the data. During the development of my Shiny app, I was able to come up with 3 distinct features that I wanted to showcase. The first is a date range picker which would allow a user to filter the data on any year from 1998 to 2017. This allows for a more fine-grain view of the data especially for my Pesticide Used VS Honey produced chart and the two map charts. The second feature I wanted to add was a state picker. My data’s 2 main axes are pounds and state, meaning being able to evaluate a single state or even a handful of states would make it a lot easier for curious people to compare data. This feature is especially useful for the Pesticide Used VS Honey Production graph, because you can filter for states that had higher amounts of pesticide use (like California, Minnesota, and Nebraska). The third feature I wanted was a way to select which graph you are viewing easily and simply. This was easily generated using radio buttons.

My big grievance with Shiny is that the graphs are generated on the backend rather than the frontend. This means the server needs to generate the graphic rather than the client device, which causes a noticeable lag. This also causes issues when first starting the app as it is generating the information the application needs to function (i.e., the date range and state picker variables – these must be created on the server, sent to the client, initialized on the client, and then sent back to the server). All of that must be done before the server can generate the first graph. Ideally the data would be sent from the server to the client, which would then locally render the graphs.

For my graphs I decided to stick to 5 major points of interest. The first is a bar chart of pesticide used data, this makes it evident which states use the most pesticides and which use the least. We can clearly see that Illinois, Iowa and California are the highest pesticide using states. The next chart is very similar except it shows honey production. This clearly shows that North Dakota is the highest producer outproducing the other states by over 200 million pounds of honey! Naturally the third graph is a stacked bar chart which shows the relation between honey produced and pesticide used in pounds. This chart benefits immensely from the state picker, as evaluating all the states makes it very hard to see the differences. Selecting California, Iowa and Illinois makes it much clearer. You can see that even though they use the most pesticides, California is still producing a lot of honey. When you look at Illinois it produces almost no honey compared to pesticide used which may be a telling story. When you just select Illinois, you can see they use almost 4.5 million pounds of Neonic pesticides and only produce roughly 10 million pounds of honey in a 19-year period.

My favorite 2 graphs, and the last 2 I added are state heatmaps. The first shows the United States Pesticide usage map. This allows you to see more clearly which states are using the most pesticides and where most of the pesticide usage comes from. We can see California is the biggest one which is supported well by the data we have previously seen. The next map is a map of the total honey production in each state. This map clearly shows that the Northern Midwest states produce far more honey than the Southeastern states. I think these two maps are my favorite and best graphs which I have included. Ultimately, I enjoyed this project, but I think if I had the time to do it all over again, I would have loaded my data into a MySQL database, created a Node.js backend and an Angular/TypeScript front end to resolve a lot of the issues and limitations that I ran into.