

Salary Gallery

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Abstract

This paper presents a tool that enhances a potential employee’s ability to evaluate a job offer. While there are existing tools that seek to accomplish them, there has been no serious effort to develop a comprehensive tool that makes understanding a job offer easy. This work discusses current tools and their limitations, as well as a proposed solution, Salary Gallery. Finally, this paper explores future work in this area.

1 Introduction

What is the best way to evaluate a job offer? Currently, many online tools exist that allow potential employees to compare different aspects of their offers, from location [1] to salary [2] to employer ratings [3]. However, insights into these different areas of a job offer are scattered across different tools, forcing users to jump between multiple tools. Because these services are found in distinct tools, the user cannot easily see how these pieces connect and influence each other. Further, many of these tools allow for limited interactivity and customizability.

When evaluating a job offer, one likely wants to understand not just the salary, location, and employer information, but also how much purchase power such a salary allows. Few job tools currently exist that also incorporate some metric to evaluate purchase power, such as cost of living or consumer price index [4], despite its importance in understanding a job offer.

We propose to create a salary data visualization tool that connects each of the relevant components mentioned above, as well as several others, so that the user can better contextualize the actual costs and benefits of his or her offer. Our visualization will also provide more interactivity than the average salary tool, allowing users to further explore and customize different potential offers. Our motivation for this project was driven by the desire to create a tool we

ourselves see a need for and would use in evaluating our own offers.

2 Related Work

Teleport, Inc. [5] has created an online tool to evaluate the best place to move to and work in. The user enters in a desired location, and can explore information about the city’s climate, cost of living, quality of life, and further links to research. The user can also compare two cities’ information. However, Teleport does not provide information about jobs and salaries in the desired city, as we seek to do. Further, Teleport has a limited amount of interactivity, providing more of an infographic experience than a way to explore data.

What is the most distinctly common job for your state?

What’s the most common job in your state? PayScale’s map reveals which jobs you are most likely to find in each state based on the relative commonness of each job title compared to all states.

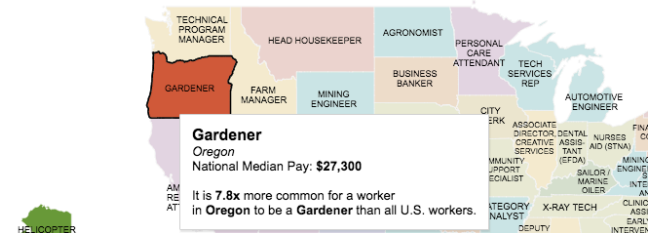


Figure 1: Payscale visualizations do not allow customizability, based on the user’s unique inputs. Source [2].

Some tools such as PayScale focus exclusively on visualization of job data. For example, PayScale has visualizations for the most common job by state, degrees that lead to the highest pay, and many more (Figure 1). However, PayScale’s visualizations, while interactive, are the same for every user. We intend to visualize only relevant data to our user, based on the user’s specific location and occupation. Our tool will include the more general information found on PayScale, but only as a way to provide context for more specific information for our user.

Other online tools, such as Glassdoor, focus exclusively on job and salary data. Glassdoor aggregates salary information about specific occupations, allowing the user to query based on the city and position. Glassdoor also provides information about different companies with the position, as well as what those companies tend to pay. However, Glassdoor's info does not provide any insight into patterns in salary data, such as historical trends. Our work will aim to provide the same information offered by Glassdoor, but will further supplement it with visualizations of the same data, as opposed to Glassdoor's text-based listings, as well as further data about historical trends.

Few interactive visualizations capture cost of living in the United States. One such tool [6] visualizes the gap between minimum wage and cost of living by county. However, this map has limited interactivity, allowing users to examine only a single county at a time, as shown in Figure 1. The interaction is limited to tooltips; as the user hovers over a different county, the corresponding information panel updates automatically. We intend to allow users to compare cost of living for different locations, minimizing unnecessary memorization for the user. Salary Gallery will maintain the tooltip information displays, but will go one step further by saving the information if a user clicks the location.

The Living Wage Map

Santa Clara County, California

	LIVING WAGE	MINIMUM WAGE	THE GAP
Parent with Spouse and Two Children	\$28.30	\$9.00	\$19.30
Single Parent with One Child	\$27.36	\$9.00	\$18.36
Single Adult	\$13.81	\$9.00	\$4.81

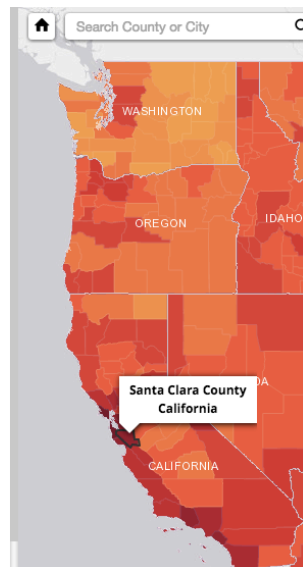


Figure 2. CityLab's living wage map, providing info for different types of families. Source: [6]

Recommender systems are closely tied with our tool, as it will eventually seek to recommend the ideal location for a specific occupation, or vice versa.

Likely, the most applicable type of recommender system would be collaborative filtering [7]. Collaborative filtering is currently used to match a new user to an existing user with a similar history, and basing a recommendation off the existing user. We see application for collaborative filtering with Salary Gallery in the future, recommending a location for a specific occupation or vice versa, based on what past users have chosen.

3 Methods

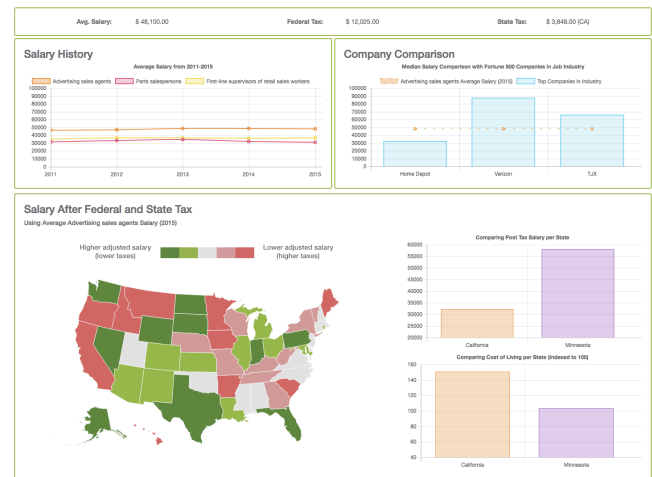


Figure 3: A four-pane layout

3.1 User interaction

Our tool is broken into four separate panes, shown in Figure 3, each designed to capture somewhat disjoint information that is traditionally found on separate tools. The top pane, Pane 1, displays text information that we did not feel integrated well into the existing visualization panes, but was still important in considering a job offer. Thus, the user can explore each pane's domain separately, but still see how each pane is related to each other. The input information needed for each pane is the same, allowing the user to enter the relevant information, desired occupation and location, only once but to see each pane visualize data related to different aspects of that information. Our user input fields are found at the top of our tool, where it will be one of the first parts the user focuses on.

The input fields are formatted as drop-down menus, allowing the user to begin typing the desired occupation, and then choose from the list of available positions we have data for via an autocomplete function. Because our list of jobs is not comprehensive, we chose to display all of a user's

options as they were typing, as illustrated in Figure 3. This prevents lag time from using error-handling; if the user enters a job we have no data for, rather than wasting time to process the occupation and alert the user that we have no data for that occupation, he or she can observe in real time that the occupation was not found, and adjust accordingly. At any time, the user can enter in new inputs, and Salary Gallery will update automatically, with very little lag time.



Figure 4: The input fields allow for quick selection of the desired occupation.

Pane 1 contains statistics related to the user’s desired job and location (Figure 5). The information includes the federal tax and relevant state tax. As this is the first pane the user will look at, it contains what may be considered overview information, allowing the user to quickly understand median salary versus both state and federal taxes. This is information that is out of the user’s control, and thus it is a relatively small, static pane, in contrast with other panes that allow the user to explore more. Information in this pane updates automatically, based on changes in location.

Avg. Salary:	\$ 48,100.00
Federal Tax:	\$ 12,025.00
State Tax:	\$ 3,848.00 (CA)

Figure 5: Pane 1 displays simple text for 3 different values. Pane 1 stretches to take up the complete width of the window.

The left pane, which we shall call Pane 2, displays exclusively median salary information (Figure 7). We anticipate Pane 2 as the first visualization the user will

focus on, and thus place the most important and relevant information to visualize here, namely salary. However, we wanted to do more than simply display the current median salary for a job. Thus, the pane shows national median annual income for the occupation specified for the past five years, as well as median annual income for comparable occupations in the same industry for the past five years. We chose this as the most relevant information, given the purpose and name of our tool.

Next, we have Pane 3, the right pane (Figure 8). This pane contains the median salaries for the desired occupation at top companies with that position. We envision this as the next tool the user focuses on, given that it is displayed on the same row as Pane 2; moreover, the user will focus on Pane 3 before Pane 4, the bottom pane, because Pane 3 is displayed in its entirety, whereas the user must scroll to see all of Pane 4. Because this is the next pane the user focuses on, we accordingly added the most relevant information to Pane 1 here. Thus, the user goes from the more broad, industry-wide occupation comparisons in Pane 2 to the finer comparisons of companies with the desired location.

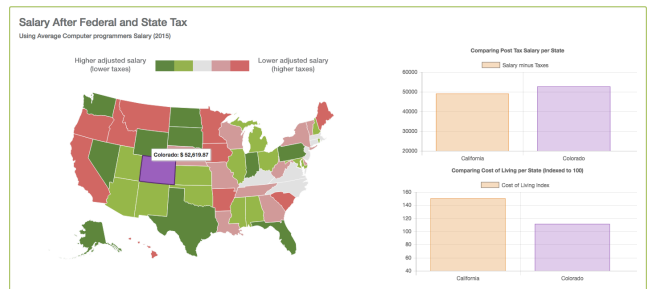


Figure 6: Pane 4 contains two visualizations for the user to better understand and compare cost of living and expendable income by state.

Pane 4 is directly below Pane 1 and Pane 2, and provides information about the take-home salary per state (Figure 6). Pane 3 first makes use of the location data, highlighting the selected state and allowing the user to compare it with other states. There are two visualizations in Pane 3; the first of which is a map of the income after subtracting federal and state tax. The second visualization allows the user to see comparisons between the desired state, and any other state the user wants to compare with. Thus, the user goes from a more broad examination of industry and national median incomes to a finer understanding of how that particular salary differs in purchase power from state to state. The two visualizations are color-

coordinated, with purple representing the comparison state in both the map and the bar chart.

3.2 Data Retrieval

In order to create usable data for Pane 1 and Pane 2, we grouped occupations from [4] into different industries. We then mapped the Fortune 500 companies onto these same industries, in order to link our separate datasets. We then further cleaned the data from [4], converting from median weekly earnings to median annual income, and aggregated separate yearly datasets into a single dataset spanning five years. We were then able to cleanly query through the various occupations for our input field, which we store. The query itself is automatic; as the user types in letters for an occupation or state, the number of options displayed lessens in order to match all of the user input (Figure 4). Once the user clicks an option for either location of occupation, the querying saves the user input and updates the panes immediately. Our final dataset [8], for cost of living by state, was from an independent researcher. The data was indexed from a national average cost of living of 100; costs of living indexes with a higher value indicate a higher cost of living in that state, and vice versa.

We gather data for Pane 1 using [9]; based on the saved occupation, we pull the occupation's median salary and classify it into a tax bracket for single occupancy. We then display the federal taxes for this tax bracket, as well as the state taxes for the stored state.

The visualization for Pane 2 uses Chart.js, an overlay on top of d3. We pulled the industry of the stored occupation, and based on this industry, displayed two other jobs in the same industry from our dataset. The visualization for Pane 3 is very similar, except that it display three Fortune 500 companies based on the stored occupation's industry.

For Pane 3, we used Datamaps, another overly on top of d3, to create the map of the United States. Once we have a stored occupation, Salary Gallery automatically calculates the post-tax salary for each state by subtracting the federal and state taxes from the median salary, divides these fifty values into quintiles, and color-codes the different quintiles from lowest to highest. The bar charts in Pane 3 use chart.js. The first bar autopopulates based on the user's selection for

location, and the second bar populates based on whatever state is clicked.

4 Results

Our tool creates in four separate visualizations for the user. Salary Gallery automatically creates these visualizations based on the inputs from the user, meaning that the runtime for generating these visualizations is very low.

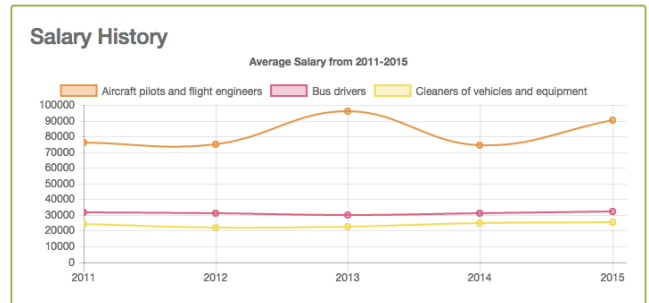


Figure 7: Salary Gallery displays the desired occupation salary in orange and comparable occupations' salaries in red and yellow colors (Pane 2).

The visualization our user will focus on first is in Pane 2, where historical information about median salary can be found (Figure 7). This information is visualized as a line graph with three separate lines, allowing for easy comparison between the desired occupation in orange and the other similar occupations in red and yellow. With this information, the user can quickly gauge how her desired occupation compares to other occupations in the same industry, perhaps providing additional context if her or she is interested in other types of jobs. If the user wants to explore other industry occupations in depth, he or she can search for them, but it is likely that the user is fairly committed to the occupation entered as input. If the user finds the extra lines too distracting, he or she can simply click the similar occupation in the key, to toggle that occupation's line off or on the line graph. We also provide functionality that allows the user to directly compare the different salaries on the graph by hovering over a specific point. In this way, the user can better gauge exactly what the difference is in income between similar occupations. One of the important features of Pane 2 is its historical data, something that is difficult to find on other sources for such a large list of occupations. We believe the user can utilize the historical data to gauge how well his or her desired occupation is doing in the job market, and

to discern whether this is an occupation to pursue or not.

Our user will then focus on Pane 3, which visualizes top company median salaries in the same industry as the desired occupation. We chose to represent this data using a bar graph, for easy horizontal comparisons between the different companies. The user will likely examine this pane next, as discussed in the previous section. For the particularly detail-oriented user, we also provide the exact salary from a particular company using a tooltip; thus, the user can more accurately compare differences. We color-coded the median occupation salary (orange) and the company salaries (blue) for quicker understanding of the comparison, as illustrated in Figure 8. The orange-colored median salary is the same as the orange coloring in Pane 2, allowing the user to understand quickly which aspect of the bar graph corresponds to his or her desired occupation salary. The simple orange dotted line allows for the user to quickly compare his or her median salary to other companies without creating visual clutter.

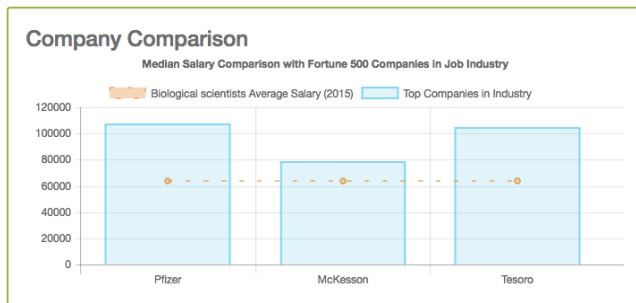


Figure 8: An orange color-coded line preserves consistent coloring from Pane 2 as well as indicates how well the median salary compares to specific companies (Pane 3).

Pane 4 contains 2 visualizations. The first is the map of the United States, seen in Figure 8, colored according to income after federal and state taxes. We included a rather explicit legend to detail what the different end colors (red and green) mean to avoid any confusion. The map colors change automatically if the user changes his or her desired occupation. Further information about this income is provided via tooltip, as shown in Figure 9. The purpose of this visualization is to quickly allow the user to pick out areas where his or her salary equates to significant purchase power.

Our final visualizations are the bar charts in Pane 4 (Figure 10). While exploring this pane, the user can

hover over other states to see their post-tax incomes; if the user is seriously considering another state, he or she can click the state and save and compare both in the bar charts. Automatically, the first bar of the bar charts are set to the state the user selected from the input field. The top bar chart allows the user to quickly compare the post-tax salary for two states, whereas the bottom bar chart captures the difference in cost of living index. Both charts update and rescale automatically if the comparison state is changed.

Salary After Federal and State Tax

Using Average Biological scientists Salary (2015)

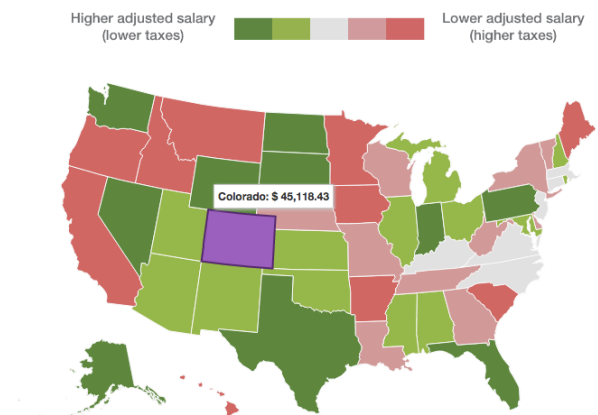


Figure 9: Map of expendable income, customized to each occupation's unique median salary (Pane 4).

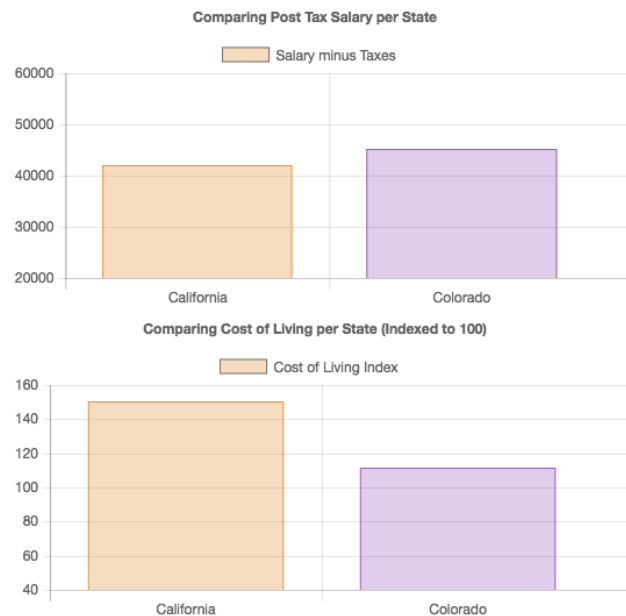


Figure 10: Comparison bar charts (Pane 4).

We carefully coordinated consistent colors throughout the visualizations, namely that orange represented the

user's information, and the purple that represented the comparison state in Pane 4. Other colors were not coordinated, in order to avoid drawing inaccurate correlations between unrelated elements of the same colors. Although this results in Salary Gallery having a multitude of colors, we believe this is more desirable than unwanted and unintended correlations.

4.1 User Feedback

Based on user feedback, a couple of our visualizations changed in order to show insight into the data more clearly. In particular, Pane 3's bar graph visualization was originally a set of three overlaid bars, displaying both the median salary of the desired occupation and each company's median salary. The original intent was to create meaning in the colored differentials of the different overlays; however, we agreed with feedback that suggested creating a cleaner bar graph with fewer elements, leading to the current design.

The bar chart visualization of Pane 4 originally did not exist. Instead, we listed the comparison values in text. However, we received feedback suggesting incorporating a visualization for an easier comparison, for which we created two bar charts.

Our overall layout for Salary Gallery was also influenced by user feedback. Originally, we considered synthesizing all the information into a single visualization, but received feedback in favor of separate panes for the different types of information. This eventually helped us clarify our goal of creating a single unified tool for a broad overview of job offer evaluations, but with finer visualizations to capture nuances in different aspects of a job offer.

5 Discussion

Our goal with this tool is to allow our audience to better evaluate and visualize data related to potential job offers. By using Salary Gallery, users understand the value in a tool that unifies different aspects of a job offer evaluation into a single interface. Instead of attempting to integrate all data into a single visualization, we decided to create 3 separate visualizations. In this way, we hope users understand the value of creating three visualizations to capture related, yet disjoint, data. Part of our design goal was to illustrate that the finer granularity of visualizations allows users to better explore each type of data in depth.

We further hope our users walk away with a greater understanding of the power of a simple, single page interface. With only two inputs from the user, we synthesized and created a variety of visualizations. We can compare Salary Gallery to other online tools with a more complicated, extensive interface, but see that Salary Gallery is still a useful and quick tool in evaluating a job offer.

6 Future Work

Salary Gallery is a functional tool that allows users to compare many different facets of a job offer. In future work, we envision a more comprehensive tool that allows comparisons between occupations with the same location, similar to our current functionality of comparing different locations for the same occupation. We further hope to add more granularity and information to Pane 4, comparing the current calculated values to a monetary value for cost of living, broken down into different expenses (housing, rent, food, etc.); in this way, Salary Gallery would predict a user's expendable income, which may be more concrete than a cost of living number. The user would also be given the option to include only particular aspects of cost of living, perhaps wanting to ignore food expenses due to free company meals. Following this addition, the next step would be to create a recommendation system from Salary Gallery for the best location to settle down on, based on cost of living versus salary versus quality of life; these features could be ranked according to importance to the user, and the results would differ accordingly.

It is our goal that eventually, Salary Gallery incorporates more of a data exploration side, allowing users to discover insights into the data we have collected on their own. For example, a user might wish to discover trends among a specific occupation in separate locations, or choose a location based on expendable income. This would likely involve linking Pane 1 and Pane 4 together, to provide a better sense of the interaction between the two panes. An improvement in the same vein would be to predict a user's future salary. Many of our goals for the future of Salary Gallery depend on finding appropriate and comprehensive enough datasets.

Our final improvement would be further customizability for the user. In future iterations, we envision a third input field, for the user's salary from

his or her potential job offer, to incorporate into our visualizations. This data point would take the form of another line on the line graph in Pane 1, another comparison bar in the bar graph in Pane 2, and would be the main data point for the tax information in Pane 4.

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