JobViz: Interactive Visualization of Majors & Jobs

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Figure 1. The JobViz Wheel for understanding employment options for college students. The wheel represents all of the data in the college career portal. College majors are along the left half of the circle, and career fields are plotted on the rest of the circle (a) The majors "Agricultural Science" and "Biochemistry" with all career fields related to them are highlighted in red with bigger font size. The connections are shown with B-Spline curves where the thickness indicates the strength of the relationship. The percentages outside the circumference of the radial layout are the correlation coefficients between the chosen major and the career fields. (b) The tag cloud in the center represents the keywords of all of the employment advertisements (job postings) retrieved during the query of the chosen majors. Each tag is color-coded by the most related career fields and has its size proportional to its frequency and is clickable to recall the specific job postings relating to that tag keyword.

ABSTRACT

Understanding the relationship between jobs and majors is of interest today in the higher education landscape but is not always straightforward. Students struggle to understand such connections. Many professors cannot provide clear links between what is being taught and opportunities that are available. In this paper, we propose a novel visual exploration approach called JobViz that allows students (and professors) to explore job posting data in a more holistic and education-centric way. The JobViz plots the relationships between majors and jobs, displays keywords of the majors or jobs selected by users, and computes some simple statistics based on the search choices. It provides an interactive view of the data within a focus+context framework. The focus+context framework is important to allow comparisons between different majors and employment groups. We worked with Rutgers Career Service and evaluated our visualization of the job database by running focus groups for undergraduate students and career counselors using our JobViz.

Keywords: Job visualization, radial visualization, large categorical data, focus+context techniques.

1 INTRODUCTION

In today's "competency based education" model, colleges and universities are being pressured to make sure students are graduating with the skills they need to be directly employed. Where do students (and others) go to get information on available jobs, desired majors, and necessary skills? Amongst other potential sources, web-based job search engines allow users to search on a number of items (education, location, level, etc.) and then present the user with a list of potential job opportunities. Surprisingly, none of these platforms presents a visual interface to the user, relying solely on text based querying and a linear presentation of results.

In this work, we built an interactive visualization tool called JobViz to facilitate exploration of the entire job posting database. Our approach is designed to encourage holistic understanding of the database and greater engagement with the career service counselors through a "focus+context" view of the data. We first provide a "context" view of the data: an overview of the jobs that are available and all of the majors and major categories. The student (or other user such as faculty and career counselor) can then navigate intuitively and focus on jobs of interest depending on their major, technical skill, class type, or type of job. A tag cloud is provided that summarizes a collection of job postings.

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2 DATA AND METHOD

The job posting data we used is from Rutgers University Career Services (http://careers.rutgers.edu/) portal. Companies fill out a questionnaire before posting a new job and this information includes: Employer, Job Title, Position Type, Date, Majors, Class Level, City, State, Category, Job Description, and which major they think is most applicable to the job posting. The database contains anywhere from 5000 to 10,000 jobs at any one time. There are three components to the visualization: the radial layout, the connections between majors and jobs, and the tag cloud of job postings.

Radial Layout. Following the "ring-based" design pattern [1], the radial layout in our system enables visualization of both majorcareer connections and related skills (keywords). The center of the layout is used for displaying major-job connection lines and tag cloud of keywords. The circumference of the wheel is further divided into two separate sections for majors and jobs. The majors are grouped either by the school that is offering the major, or by related majors (life science, engineering, etc.). Jobs are grouped into job categories which represent industry sectors (e.g., Accounting, etc.) and then are further grouped into career fields [2].

Major-Job Connections. The relationship between major and job is represented as connection curves. In our approach, we use a piecewise cubic B-splines model to represent the connection curves and followed the technique of Hierarchical Edge Bundles in [3].

Tag Cloud of Keywords. The tag cloud [4] summarizes the essential keywords in the posting which represent a collection of skills, industry knowledge, and other tracts. All of the terms in the tag cloud, as well as the career fields and position type on the outer ring of the radial layout, are linked to the actual job postings.



Figure 2. An overview of JobViz. The radial layout displays the job to major connections for career field "Art & Entertainment". It is further spread out into seven sub-fields, each of which contains three types of position represented as bar outside. The table in the left part lists ten most-related majors. And the table on the right lists the relevant job postings of internship in the "Film" sub-field. The breadcrumb trail on the top offers constant context as users browse the visualization.

3 JOB VISUALIZATION

The JobViz tool we created is a web-based application implemented by Data Driven Documents (D3, <u>https://d3js.org/</u>). An overview of JobViz is displayed in Figure 2. The system consists of three main parts: the left part for controlling panel and keyword searching; the central part for the data visualization; and the right part for listing the actual job posts. All of the parts are interactive and every part is linked. Figure 3 illustrates how two full-time entry level job positions for the career field "Business" are identified.

Connections between job and major can also be displayed. If a user clicks a career field, the curves displayed connect it to the majors that all of the job postings of the career field are requesting. Figure 4 shows the scenarios when clicking on the career fields "Education" and "Communication". Words from the job postings relevant to chosen majors or career field are combined into a tag cloud which forms an alternative visualization (Figure 1(b) and Figure 3). By linking these terms to specific career fields and job postings we facilitate the exploration of relevant skills.



Figure 3. Searching for a job starts with identifying a career field, finding the connected listing of positions at the desired level, and then reading individual job postings.



Figure 4. Choosing "Education" (left) rather than "Communication" (right) leads to a denser set of job to major connections.

4 USER STUDY

To evaluate the quality and benefit of our job exploration visualization tool, we conducted a pilot user study with five career counseling specialists and ten undergraduate students. Both specialists and students were impressed with the innovative visual connections and dynamic interactivity of our interface into a job posting database.

5 CONCLUSION

In this paper, we explored the use of information visualization techniques for job visualization. We developed a tool called, JobViz, primarily for students to explore the connections between majors and job postings. By stressing a 'focus+context' view of the data, we present the student with a holistic view of the entire database and the ability to explore connections in a more intuitive and facile manner.

REFERENCES

- Draper, Geoffrey M., Yarden Livnat, and Richard F. Riesenfeld. "A survey of radial methods for information visualization." *Visualization* and Computer Graphics, IEEE Transactions on 15.5 (2009): 759-776.
- [2] https://career.berkeley.edu/InfoLab/CareerFields
- [3] Holten, Danny. "Hierarchical edge bundles: Visualization of adjacency relations in hierarchical data." *Visualization and Computer Graphics, IEEE Transactions on* 12.5 (2006): 741-748.
- [4] Hearst, Marti A., and Daniela Rosner. "Tag clouds: Data analysis tool or social signaller?." *Hawaii International Conference on System Sciences, Proceedings of the 41st Annual.* IEEE, 2008.