Nonprofit Credit Score

A System to Assess Nonprofit Financial Performance

Jerry Song, Alex Nocella, Haroon Choudery

Problem Addressed

Recent events involving the American Red Cross' involvement in Haiti have illuminated frustrations in the nonprofit sector that have persisted for decades. Nonprofits are held mildly accountable for inefficient employment of donations and most donors do not understand enough about different nonprofit organizations in order to make proper judgements about which nonprofits to donate to. As a result, the nonprofit sector has been far from efficient at squeezing value out of the amount of donations and funding that it receives. By leveraging the power of data, Nonprofit Credit Score helps donors understand how financially efficient nonprofits are (compared to other nonprofits within the same sector) so they can make more informed decisions by reporting a "credit score" that takes into account the most important financial metrics for nonprofit organizations.

Calculating the Credit Score

We generate a raw score equal to the sum of 8 financial ratio scores which we believed to be the most important, each in the range [-2, 2]. There is an additional +/- 0.5 raw score modifier depending on whether revenue growth was higher/lower than expense growth respectively (only applies to Form 990, not 990EZ). The coefficients for the ratios were determined by sampling 2,000 forms to get a sense of the distribution of each ratio. In general, the [-2, 2] ratio score should be ~1 on average and only negative for clearly bad results (e.g., negative asset growth, very high debt, etc.) If the sum across all ratios is exactly 0, we assume the form did not have sufficient information, so we do not assign a credit score. Otherwise, we accept the raw score and convert it to a credit score. If some fields are missing, that ratio score will be 0. There is roughly a 10% incidence rate of missing credit scores.

The 8 ratios are:

- **Operating reserve** = (Net assets) / (Total expenses)
- **Growth in net assets** = (Ending net assets - Beginning net assets) / (Beginning net assets) - 1
- **Operating efficiency** = (Total revenue) / (Total assets)
- **Net margin** = (Total revenue - Total expenses) / (Total revenue)
- **Growth in total assets** = (Ending total assets - Beginning total assets) / (Beginning total assets) - 1
- **Leverage efficiency** = (Total revenue) / (Net assets)
- **Debt ratio** = (Total liabilities) / (Total assets)
- **Financial leverage** = (Total liabilities) / (Net assets)

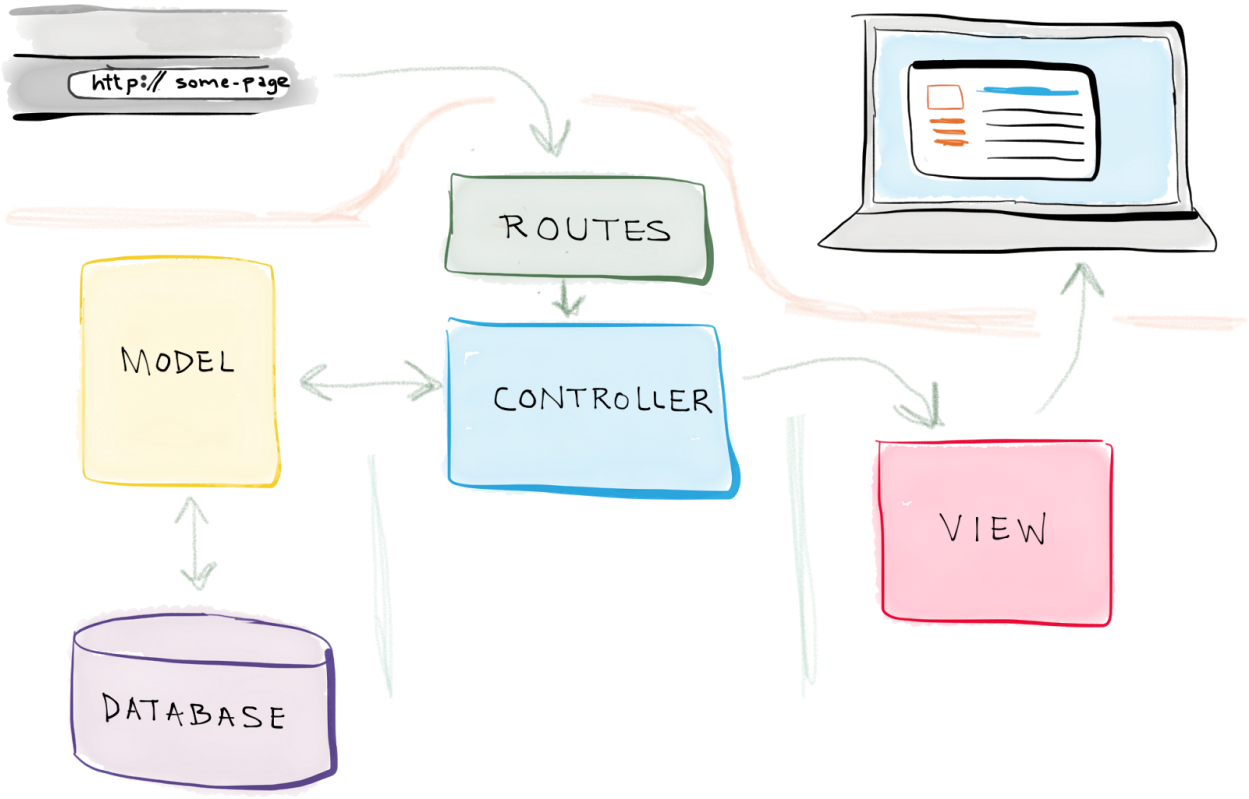
The conversion from raw score to credit score is a logistic function with a slope coefficient of 0.25.

The credit score ranges from 300 to 850 to look like a FICO score, and it has a similar distribution to personal FICO scores (a sample of 900 nonprofit organizations yielded an average score of 703 with a range of [392, 816] and standard deviation of 106).

Architecture Overview

Our product contains two major components: the web application and the database. The app is built on MVC (Model-View-Controller) framework and provides RESTful web services. The database uses MySQL. Both the web app and database are hosted in the Amazon EC2 instances, and are open to the public for access. Here, we will give a brief introduction of the product architecture and workflow.

We use Flask framework to build the backend, Bootstrap framework for the frontend, and various Python scripts to handle the business logic. Both Flask and Bootstrap and micro-frameworks which are simple to use and enable fast iteration. We selected MySQL as our database mainly because the schema of our data object is fixed and known in advanced. In addition, our application is read intensive and MySQL performs better in terms of read speed than its major competitors, such as PostgreSQL.



The above diagram shows the MVC workflow in serving data to the end user. The Bootstrap code works as the “View”, and renders the HTML page for the user. The Flask code is the “Controller”, which defines URL routes and invokes the “Model” to process the user request. The “Model” contains multiple Python scripts, which handle the business logic and access the database to fetch the necessary data.

Another major workflow of our product is populating the database. The original data source is hosted by Amazon on S3 and is publicly accessible. For each non-profit organization, its tax form is stored on an XML file and there is a index page in JSON form which contains the URL to each organization’s XML page. Our product contains two Python parser script - one that reads the index JSON page and extract the URLs for the XML, and another that processes the XML page, extracting useful information and storing it to the MySQL database.

For instructions on setting up the web application and database, please refer to the README.md file in our github repo. For implementation details about our product, please check the code files. There should be enough documentation and inline comments.

Implementation Details

(Note: This information is contained within the **Readme.md** file)

Results and Moving Forward

Upon the completion of the Nonprofit Credit Score project, our team is itching to implement more functionality in order to make further use of the public nonprofit data. We are happy with the functionality of our application and can see the usefulness of the website for the average donor. Our front-end makes it very simple to visit the website, type in an organization ID, and get a simple metric that encapsulates the firm's financial health. The report also includes other key metrics that may be of interest, as well as the percentile of the given organization's credit score.

We plan on continuing the work that we've laid out in the Nonprofit Credit Project. Our two main focuses are to improve the score quality and to improve the web application quality.

- Improve Score Quality
    - Include various data source. Currently, we only leverage the tax data
    - Apply statistical hypothesis tests and data mining technique to the raw data to extract more value from the raw data
    - Analyze the difference between nonprofits and commercial organizations for more accurate evaluation algorithm of the nonprofits
- Improve Web Application Quality
    - Add a layer of web server for cache control, load balance, and proxy server
    - Integrate with external tools, such as Tableau, for better data visualization
    - Integrate with NoSQL database to store adhoc data specific to individual nonprofits