High School Graduation Rates

Background

- We will build a classification model which classifies high schools as either having a low or normal graduation rate. The distinction between low and normal graduation rates is based on the federal government's standard that those schools with less than two thirds of class graduating are low graduation rate schools.
- Limitations:
  - Our data is limited to only those schools which reported their graduation rates
  - We looked at one year of data choosing 2015 as this was the year with the most complete reporting at the school and district level

Business Problem

- Predict which schools have low (66% and below) and which schools have normal (67% and above) high school graduation rates. Identify which characteristics are the best indicator of low and normal graduation rates so that school districts know where to focus resources when attempting to increase high school graduation rates.

What data did we use?

- Every year, the federal government releases large amounts of data on U.S. schools, school districts, and colleges. But this information is scattered across multiple datasets that are often difficult to access, and changes in data structure complicate efforts to measure change over time. The Urban Institute (https://educationdata.urban.org/documentation/index.html) has organized and consolidated this data to make it easier to combine data from different reporting sources.

- Using the Urban institutes consolidated data platform we will be combining datasets describing characteristics and metrics of individual schools with data describing characteristics at the school district level.

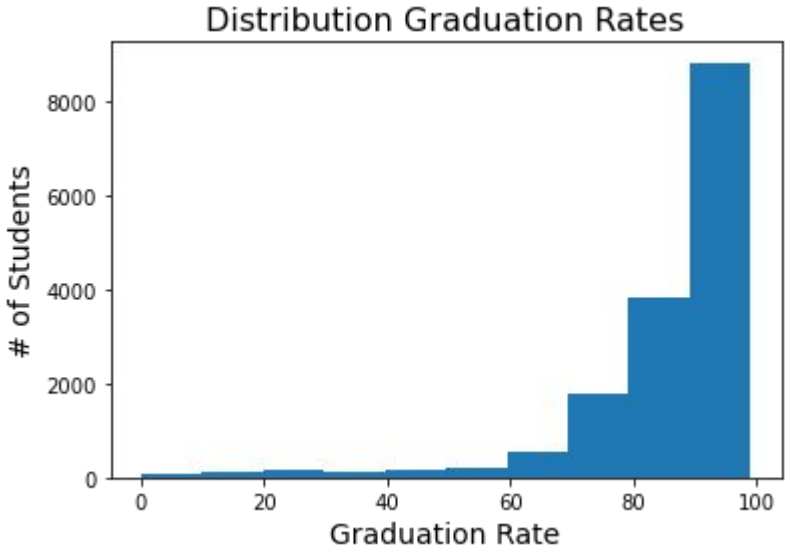
Data Fields

- Our school level data contains information on the school location, degree of urbanization, school size, number of students proficient in math and reading assessments, number of allegations for harassment/bullying, number of students enrolled in specific subjects, number of disciplinary actions taken, and number of students participation in ACT/SAT tests.

- Our district level data contains financial information for each school district. This includes type and amount of capital outlays, debt outstanding at the end of the fiscal year, district expenditures, and revenue. District data also includes number of English language learners, employee benefits, and salary for instruction.

Distribution of National Graduation Rates

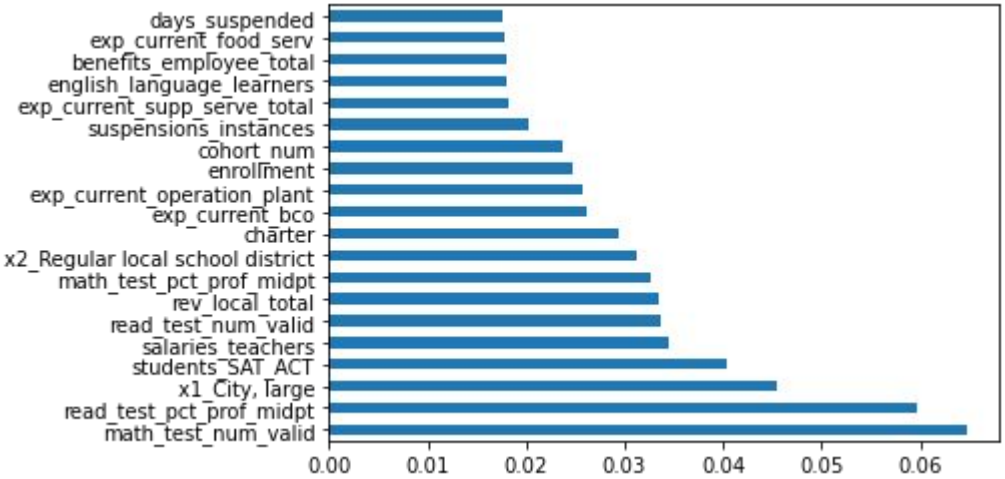
- Graduation rates are skewed towards low graduation rates. Low graduation rate high schools are the minority class making up less than 10% of all high schools.
- We will need to adjust for this imbalance in the modeling stage



	Graduation Rate	% of Schools
Low Graduation Rate	0-66	7%
Normal Graduation Rate	67-100	93%

How does a Convolution Neural Network classify images?

- In human understanding characteristics like the trunk or large ears are how we recognize an elephant. For the computer, we need to provide it an algorithm to teach it these characteristics as boundaries or curvatures. And then through the groups of convolutional layers the computer constructs more abstract concepts.

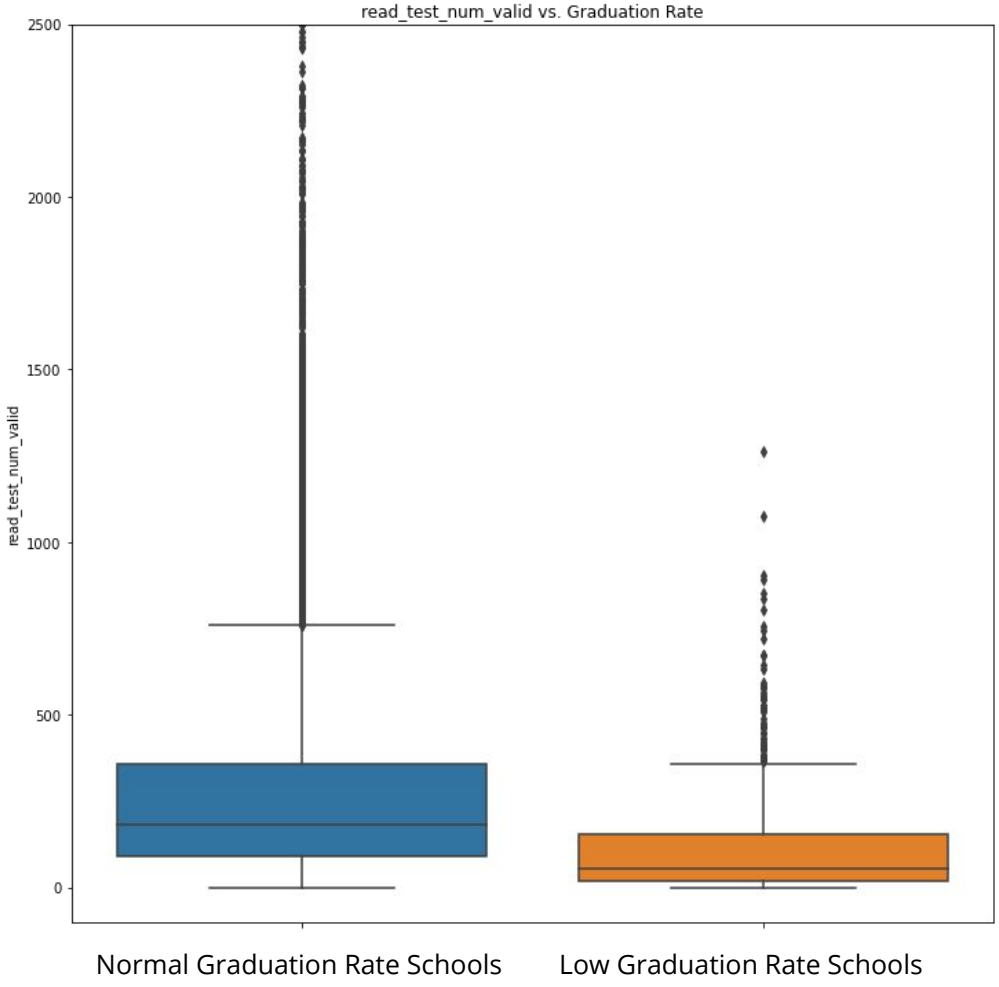


Reading

Higher reading test proficiency was associated with normal high school graduation rates

These boxplots pull the number of students participating and achieving a proficient score in reading tests

The graph tops out at 2500

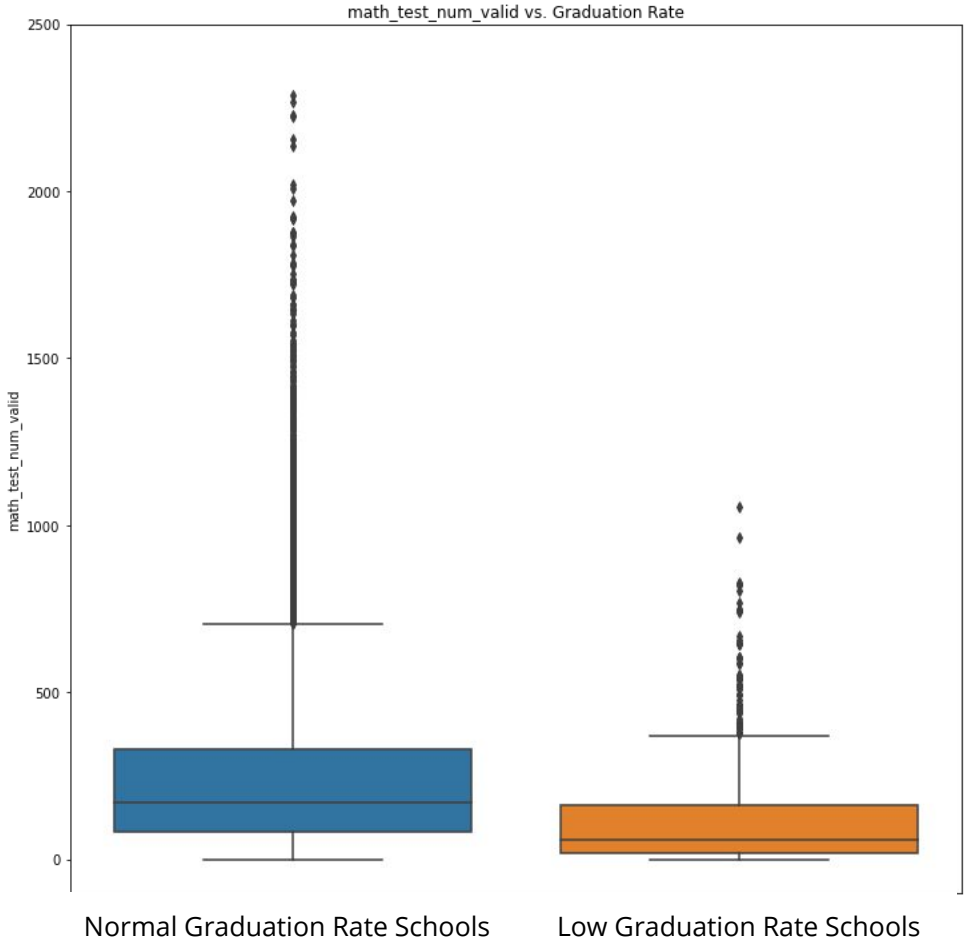


Mathematics

Higher math test proficiency was associated with normal high school graduation rates

These boxplots pull the number of students participating and achieving a proficient score in math tests

The graph tops out at 2500

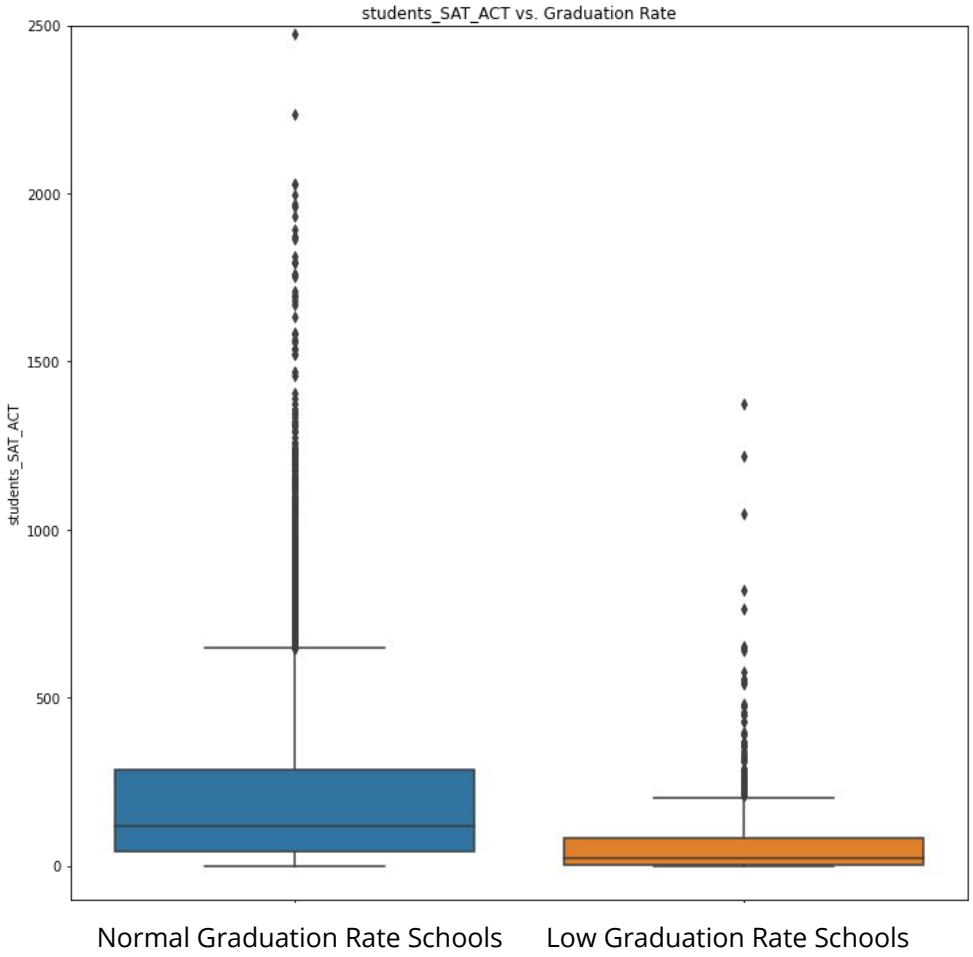


ACT/SAT Participation

Higher ACT/SAT participation was associated with normal high school graduation rates

These boxplots pull the number of students participating in ACT/SAT in schools

The graph tops out at 2500

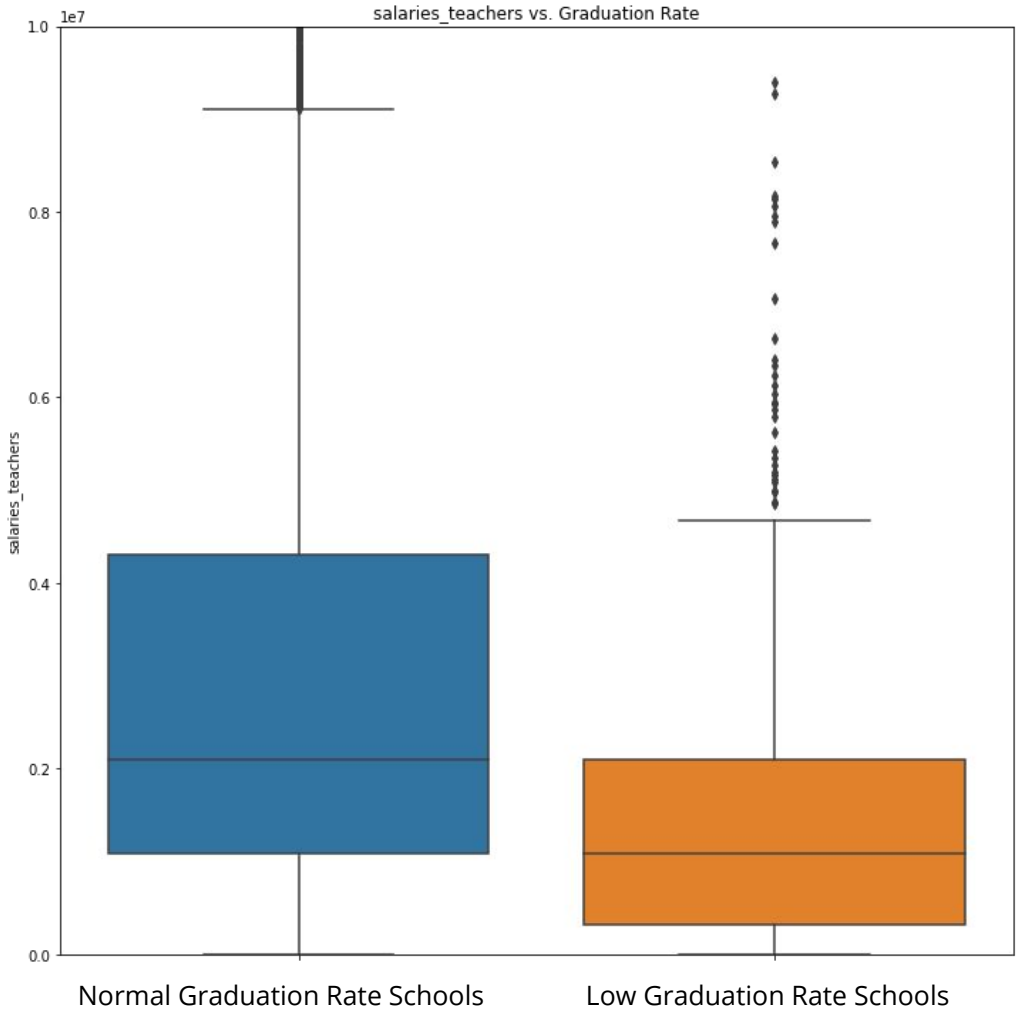


Teacher Salaries

For our financial factors the teacher salaries were the most important indicators. Higher budgets for teacher salaries was associated with a normal graduation rate.

These boxplots pull from the total budget for teachers salaries for each district.

The graph tops out at 10 million



Conclusions

- Our modeling struggles with overfitting and is better at classifying the majority class (normal graduation rate). However, we were able to achieve a high enough performance that we feel confident in making recommendations based on the the features which had the greatest feature importance for our modeling.
- The number of students who completed math and reading tests and received a proficient grade were major indicators for higher graduation rates.
- Our modeling showed that the proportion of suspensions and lengthier suspensions were a major indicator for low graduation rate high schools.
- The number of students participating in ACT/SAT tests was a strong indicator for our model. Higher participation meant higher likelihood of being in a normal graduation rate group.
- Teacher salaries was the most important financial factor. Higher teacher salaries were an indicator of normal high school graduation rates.

Recommendations

- Mathematics and Reading: Focus resources on providing extra support for mathematics and reading. School districts should investigate the best way to improve these scores whether it be through offering remedial opportunities additional tutoring or increasing testing practice for these specific areas.
- Suspensions: Although, these metrics are not easily separated from other influencing factors. We can broadly say that behavioral issues have a negative impact on academic success. Additionally, there is a large and accepted body of research in the education field that dealing with behavioral issues by keeping kids from coming to school is unproductive and has negative impacts on academic success. School districts and administrators should investigate more productive disciplinary recourse than suspensions and explore preventative measures that help students work through behavioral issues.

Recommendations

- ACT/SAT: As with many education metrics ACT/SAT participation likely also has a relationship with school funding and other types of factors. However, regardless of other factors ACT/SAT prep can be a motivating factor for students even at underfunded schools. With the view that the main goal for students in high school is to prepare themselves so they will be accepted into college
- Teacher Salaries: Teacher salaries is a the top financial feature for our modeling an is also more easily influenced by school districts than other financial factors such as local revenue. We recommend making teacher salaries the top priority in budgeting plans as this was a strong indicator for higher graduation rates.
- Wait until future work is completed to use a model as a primary classification technique

Future Work

- Perform feature selection steps to improve overfit of the modeling.
- Investigate adding new features. Now that we have a better handle on which types of features are important we should investigate adding new features from our reporting sources and also engineering new features with the data we already have on hand. Engineering features to make them proportional to the overall population of the graduating class could make them stronger and more informative.
    - For example, % of students participating in ACT/SAT per cohort would be a much better metric than the total number.
- Investigate which types of schools did not report graduation rates. We need to know if we are missing any important type of data for unreported graduation rates. Is the type of schools not reporting graduation rates similar to those that do report?

Questions

Thank you for your time!

Sources

- https://www.businessinsider.com/united-states-regions-new-england-midwest-south-2018-4#-east-south-central-stretches-north-from-mississippi-and-alabama--9
- https://educationdata.urban.org/documentation/index.html