

# SeligoAI: Improving University Recruitment Cost and Student Retention with Custom Algorithms enabled by Machine Learning on AWS



## Executive Summary

SeligoAI is an innovative software company that seeks to challenge the established university admissions and student progress tracking model. Their recruitment and retention platform uniquely integrates probability analysis into the funnel management system employed at universities and colleges. Probability analysis is generated by machine learning through the application of multiple algorithmic calculations. The resulting probability values simplify student evaluation by identifying core strengths and challenges in each student's portfolio providing contextual intelligence to impact decision making in the University's relationship management strategy. These individual evaluations are supplemented by various data points, cohort-based analytics, and unique software applications which allow insight into recruitment and retention trends. The more that SeligoAI is applied to student data, the more accurate and insightful it becomes.

"ClearScale recognized the importance of AWS' Machine Learning paradigms to SeligoAI's value proposition and their ability to generate probability-based intelligence. Complex AI algorithms also continuously modify the Working Dataset and continually refine the predictive model which refreshes the probability analyses. This feature provides evolving value and contributes to the sustainability of the universities and colleges. Essential to this set of core calculations is AWS' ML platform."

Gregory Jordan, SeligoAI

SeligoAI can reduce multi-channel marketing costs by 25-35% by adjusting expenditures based on success indices and utilizing targeted marketing tactics based on students' interests (i.e., student archetypes and intelligence created by autocluster analyses). SeligoAI can significantly contribute to increases in Net Tuition Revenue because of the following:

- Improvement in the efficiency and productivity of recruitment staff because they can allocate more time to cultivating prospective students' interest earlier in the funnel management process based on success indices, geospatial analyses, and student search criteria analysis.
- Timely performance of the retention staff based on planning, student support programs, and the use of management tools like the success indices, student table/individual student accounts, student search, and push notifications.

## The Challenge

Ensuring student success in higher education is a key driver for many universities. Many institutions invest heavily in understanding how student performance data, standardized testing, and behavior-based activities impact their ability to succeed in college, and ultimately in their ability to graduate with a degree. Potential student candidates provide basic information to college entrance counselors. The decision-making process to admit a given student or to assist a student may be prone to subjective assessments and to errors in judgment. Gaps in understanding of how students interrelate in diverse social environments and under stress further complicate the learning process.

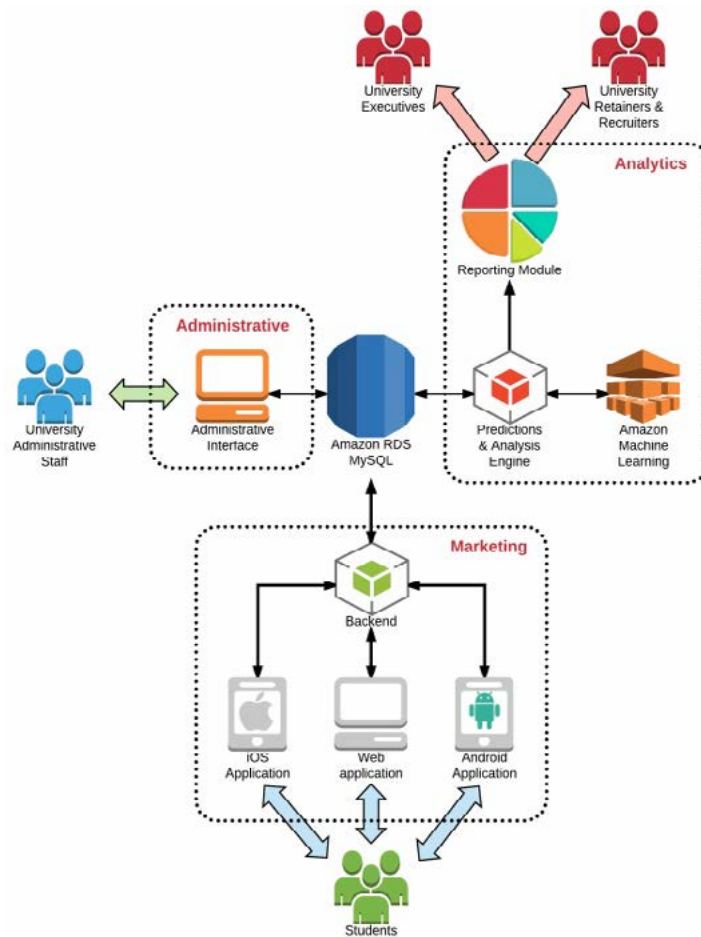
ClearScale, an AWS Premier Consulting Partner, was approached by SeligoAI who felt that developing a cloud-based solution could hold the key to aggregating and analyzing disparate data sets from universities. SeligoAI needed to use game-changing machine learning paradigms and provide informed prediction-based intelligence to college administration staff. This information can not only be used to identify how successful candidates might be once they enter college, but will also allow the institution to track the students' progress and foresee patterns or potential barriers to academic life. By identifying these patterns, the institution can take action to proactively alleviate these expected issues through comprehensive outreach programs.

## The ClearScale Solution

After an extensive review of the SeligoAI's requirements and business goals, it was determined the best approach for success was to design an integrated single tenant platform for educational institutions including four main parts: Analytics, leveraging Amazon Machine Learning, marketing, and application administration modules.

The resulting solution is accessible to select university management and executive staff via web and mobile applications that were built using AWS Cognito for authentication, Yii — an object-oriented component-based PHP web application framework, and AWS SNS for push notifications. This allows college and university staff to take action on analyzed data directly and have students provide a range of information about themselves, their interests and their ambitions.

## The Analytics Administrative and Marketing Modules



The key feature of SeligoAI Solution is the set of success indices. They were designed to help university/college staff and executives to evaluate individual student success. Indices are values from 0 to 1 indicating probability of student success in college or university. The ML enabled regression analysis algorithms provide an index value for each student or prospective student compared with the performance of the institution's former students. Each of the index calculations uses various standard academic, co-curricular, and financial aid variables as analytic parameters.

Students are divided into three groups:

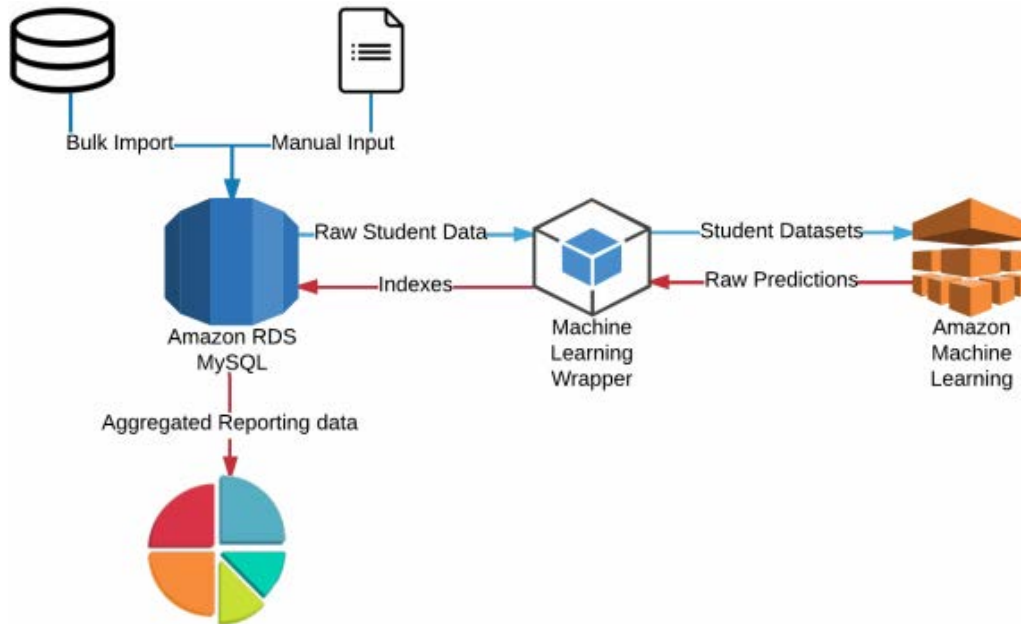
- **Prospective** — High school graduates, who are not yet enrolled in college or university
- **Active** — Students who are currently enrolled in a college or university
- **Former** — Students who previously attended the college or university

The entire SeligoAI platform is built to gather the statistical data for calculation of indices and to provide college/university staff with predictive analysis based on these indices.

Leveraging SeligoAI's predictive analytics and aggregated reporting, colleges and universities can analyze hundreds of thousands of prospective students to identify likelihood of student potential and challenges, and can select those students who best represent the University's enrollment objectives. All student raw data can be uploaded into SeligoAI's system in a single large file.

One of the technical challenges of the project was to develop the validation process for two hundred data fields per student to be included in a single upload file. To handle this complex process, the ClearScale team has implemented a fully scalable “bulk import” function able to process large bulk files, tested successfully at 250k+ students.

### Solution Data Flow Diagram



### Amazon Machine Learning

To make the application truly beneficial to SeligoAI and the universities and colleges that would use the system, ClearScale developed complex AI algorithms enabled by Amazon Machine Learning to study patterns and behaviors of a population by analyzing large sets of data. The results are then used to determine expected behavior or patterns of smaller populations of data by comparing it to the original set of learning results.

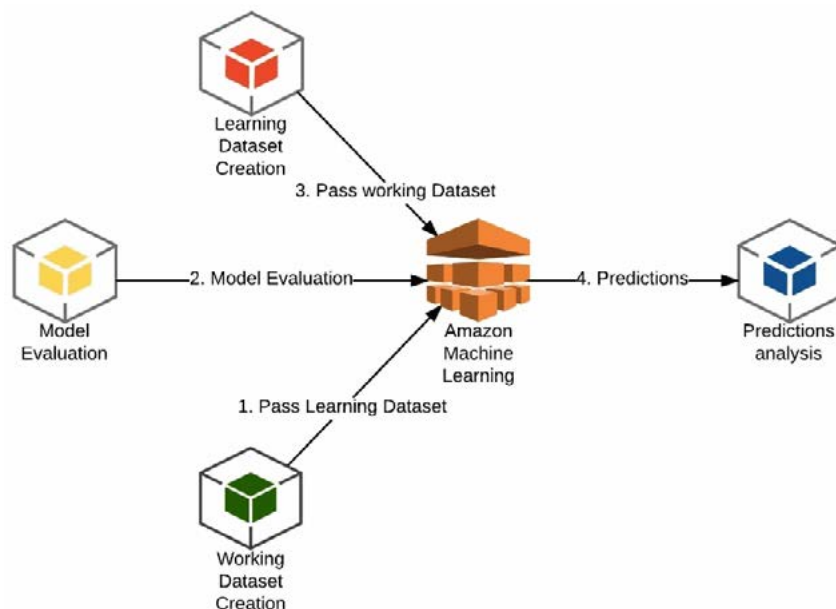
Taken a step further, Amazon Machine Learning allows the system to constantly go through a refreshed learning cycle by taking in new data points and processing them through those same complex AI algorithms to determine if the original results have changed based on changes in behavior or data in the population data set. This allows the system to learn and provide fresh insights to the predictive models with the additional variables; this in turn translates into more refined determinations of student success or areas of expected difficulty in school. SeligoAI provides this complex and advanced technology to university staff with just the click of a button. Using auto-clustering functionality, school staff can analyze a student in relation to school-determined groups based on various data points customized by the university.

All complex prediction calculations are processed by the SeligoAI application on the AWS Platform. Because of the high processing load of complicated analysis algorithms, and depending on the number of students in the school's database, the Amazon Machine Learning process could potentially take up to two to three hours for each index, if not optimized. To improve the speed of these calculations, the ClearScale team designed and implemented a special engine to simultaneously process these background calculations. Specifically, the parallel background data processing on EC2 instances was implemented. When a user uploads ZIPped student data file - it gets broken down into segments and simultaneously processed by several EC2 instances at once. This drastically decreased the total processing time for all indices to just around 20 minutes for the same size dataset.

SeligoAI uses sophisticated algorithms enabled by Amazon Machine Learning to make predictions of student success evaluated in indices. Interaction with Amazon Machine Learning includes four main functions:

1. **Working Dataset** — Amazon Machine Learning creates a model of student success based on existing data from the students who graduated.
1. **Model Evaluation** — Amazon Machine Learning evaluates the data and checks if it is correct based on the number of fields required and quality of data.
1. **Learning Dataset** — if a model was created properly, application passes info to Amazon Machine Learning, including prospective and active students' data.
1. **Predictions Analysis** — at the end of process the application retrieves data from Amazon Machine Learning predictions engine which is then analyzed and saved in the form of indices in a database.

### Amazon Machine Learning Functions Diagram



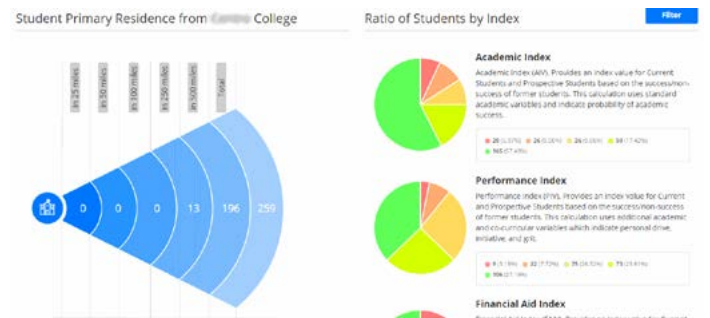
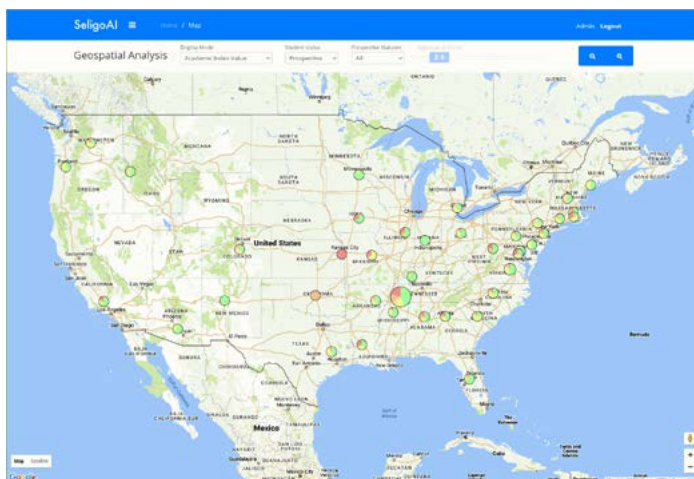
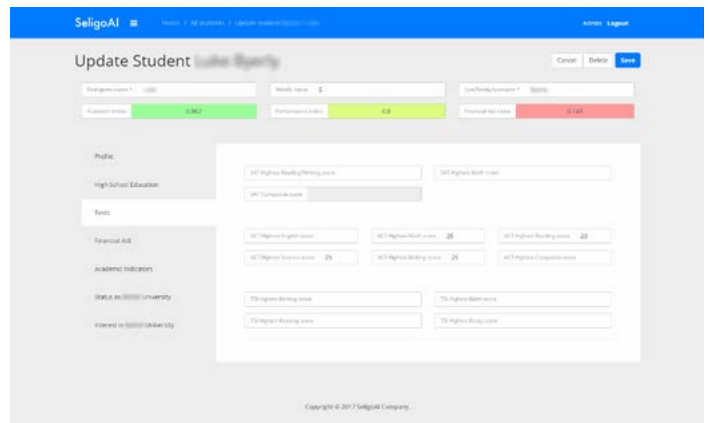
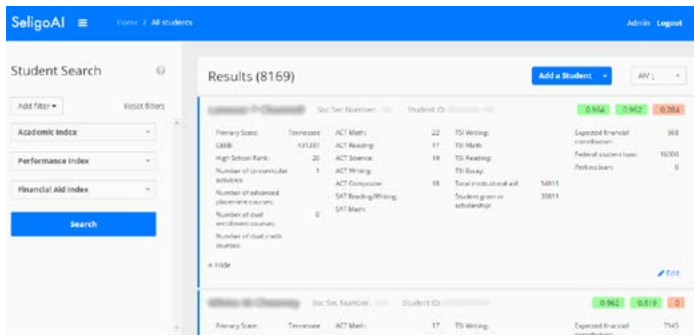
## The User Roles and Application Interface

Administrative dashboards were customized for each User Role, affording each administrator access to student data, information, and applications appropriate for their responsibilities. Important student stats and sophisticated reporting functions facilitate recruitment and retention program development.

The application also provides user interfaces with which to manage student data, either manually or through digital transfer. Analytical tools to search for patterns and trends in student performance were also developed; probability analytics were consistently integrated into these applications.

SeligoAI's administrative interface manages individual universities or colleges on the tenant-based system. SeligoAI also provides setup and configures those instances for each institution. Once a licensing agreement has been developed, SeligoAI gives the university's or college's system administrator access to the Instance's Settings. Each institution independently manages its own SeligoAI account and can request customizations to accommodate its recruitment and retention program.

## Administrative Interface Screenshots



## The Value and Benefits

SeligoAI's solution provides a range of analytics designed to give universities and colleges a data-informed recruitment and retention platform. Their systemic approach to student recruitment creates opportunities for process improvement and improved results. Random, sometimes minimally-informed decision-making occurs during the recruitment and retention processes. By engaging directly with prospective students early with the proposed solution, SeligoAI believes that a quantitatively derived evaluation, highlighting strengths and challenges, would reduce attrition in the student body and save in recruiting costs by streamlining the application and evaluation process.

**Projected Value Example: A school of 2000 students that improves its retention and persistence rates across several entering cohorts using the SeligoAI platform will not only improve student success rates, but also stabilize its net tuition revenue levels. A net increase of 5% could generate hundreds of thousands of dollars or exceed \$1 million in tuition revenue increases depending upon the average net tuition revenue level of the university or college.**

There is an additional advantage to each university or college having their own AWS instance with which to compile and analyze their unique student body data sets. SeligoAI can provide aggregated statistical information which allows each institution to discern enrollment patterns or academic-related behaviors. To summarize, the main benefits to the Colleges and Universities include:

### Reducing Marketing Costs

- By conducting targeted marketing campaigns to prospective students earlier in the recruitment cycle based on the three Success Indices.
- By conducting marketing campaigns to prospective students based on geospatial analyses; insight is afforded based on historic student markets and current student markets. Geospatial market intelligence enables the strategic use of funds to high-priority markets.
- By developing communication flows to diverse student groups which describe the alignment of institutional resources with the expressed interests and academic performances of prospective and current students.
- By exploring new student markets through the use of the three Success Indices and Geospatial Analyses.
- By offering insight into the common interests of students through the use of the advanced 'Student Search' feature which researches 200 fields of information about each student.
- By providing observations into student groups based on 200 fields of information through the use of the Autocluster feature.
- By providing market intelligence throughout each phase of the funnel management process: prospect, inquiry, applicant, accepted, deposited, registered, and matriculant, based on the three Success Indices and Geospatial Analyses. Strategic marketing and recruitment pivots can be made based on changes in students' responses and Success Indices.

### **Optimizing Institutional Resources**

- By managing recruitment resources in response to changes in student markets and student market potential as displayed by Dashboard indicators and cognate applications. SeligoAI's automated reports and applications facilitate timely management decisions.
- By managing student interests in each interval of the Success Indices, attempting to align institutional resources to support and celebrate student potential, and making data-informed decisions.

### **Reducing Financial Aid**

- By allocating institutional funds and resources to students and student families informed by the Student Success Indices and reports of allocated resources.

### **Higher Retention**

- By gaining key insights into student performance through the Success Indices and planning to implement student success programs which result in improved retention, persistence, and graduation rates.
- By maintaining an informed, meaningful, and supportive relationship with each student through the use of the Student Table and Individual Student Accounts which contain salient information. Retention staff will maintain a positive working relationship with students who were identified as needing such by the Success Indices.
- By sending push notifications to ALL students apprising them of the university's or college's resources during their enrollment at the institution as during recruitment period. Marketing communication flows continue throughout the students' time at the university or college.

With the continued evolution in Machine Learning algorithms, ClearScale and SeligoAI are confident that the solution will increasingly provide refined evaluations of student performance with gathering more unique student data points over time.