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| **Assurance of Student Learning Report****2022-2023** |
| *Replace this with your College Name* | *Replace this with your Department Name* |
| *Replace this with your Program Name and Reference Number* |
| *Replace this with the program director and/or assessment coordinator* |
| ***Is this an online program***? [ ]  Yes [x]  No | Please make sure the Program Learning Outcomes listed match those in CourseLeaf . Indicate verification here [x]  Yes, they match! (If they don’t match, explain on this page under **Assessment Cycle)** |

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| ***Use this page to list learning outcomes, measurements, and summarize results for your program. Detailed information must be completed in the subsequent pages. Add more Outcomes as needed.*** |
| **Program Student Learning Outcome 1: Write computer programs to utilize and analyze large datasets.** |
| **Instrument 1** | **Assignment 1 in CS 555.** |
| **Instrument 2** | **Assignment 2 in CS 555.** |
| **Based on your results, check whether the program met the goal of Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Student Learning Outcome 2:**  **Understand the statistical approaches taken when dealing with large sample sizes.** |
| **Instrument 1** | **Assignment 2 in CS 555.** |
| **Based on your results, check whether the program met the goal of Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Student Learning Outcome 3: Understand the statistical approaches taken when dealing with multiple variables.** |
| **Instrument 1** | **Assignment 4 in the CS 555.**  |
| **Based on your results, check whether the program met the goal of Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Program Student Learning Outcome 4: Combine domain expertise with programming and statistical skills to analyze large domain‐specific datasets.** |
| **Instrument 1** | **Term project in CS 555.** |
| **Based on your results, check whether the program met the goal of Student Learning Outcome 4.** | **[x]  Met** | **[ ]  Not Met** |

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| **Program Student Learning Outcome 1** |
| **Program Student Learning Outcome**  | **Write computer programs to utilize and analyze large datasets.** |
| **Measurement Instrument 1**  | Students are required to use Python or other programs to retrieve data from large-sized data files, manipulate the data for data analytics, and output analytic results.  |
| **Criteria for Student Success** | Students achieve an intermediate or higher level.  |
| **Program Success Target for this Measurement** | 80% of students achieve an intermediate or higher level.  | **Percent of Program Achieving Target** | 83% |
| **Methods**  | Students are required to write Python programs to read users’ ratings on movies from four movie rating files. The next step is data cleaning. Students need to check whether there exist any missing data and duplication before analysis. The cleaned data samples are saved in the format of pandas dataframe or numpy array according. Students use built-in pandas functions to count the total number of users and items and then compute the average ratings of a specific group of users. The student needs to select some rows and columns of the dataset for the required features. Finally, students are required to write Python programs to display the analytic results on the screen and also save the results into files. All six students in the class were assessed according to the rubric O1.  |
| **Measurement Instrument 2** | Students are required to use Python built-in methods to obtain analytic results.  |
| **Criteria for Student Success** | Students achieve an intermediate or higher level. |
| **Program Success Target for this Measurement** | **80%** | **Percent of Program Achieving Target** | **83%** |
| **Methods** | Students need to select correct analytical models for predicting the users’ ratings on movies. The linear regression and the logistic model are two commonly used machine learning models to describe linear relationships in the dataset. Students first use part of the dataset to train the models and then predict users’ ratings with the models on the other part of the dataset. The prediction results are evaluated by predication accuracy. All six students in the class were assessed according to the rubric O1-2. |
| **Based on your results, highlight whether the program met the goal Student Learning Outcome 1.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| **Results**: All the results are expected. Python program was used in CS 555. Data input, output, and pre-processing were examined in relation to the certificate learning outcome. **Conclusions**: All the datasets used in this course contain thousands of data instances with multiple features, and the assessment methods work. No change is needed.**\*\*IMPORTANT - Plans for Next Assessment Cycle**: This outcome will be assessed when CS 555 is offered next time.  |

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| **Program Student Learning Outcome 2** |
| **Program Student Learning Outcome**  | **Understand the statistical approaches taken when dealing with large sample sizes.** |
| **Measurement Instrument 1** | Students are required to use hypothesis testing and confidence interval to explore users’ movie preferences.  |
| **Criteria for Student Success** | Students achieve an intermediate or higher level. |
| **Program Success Target for this Measurement** | 80% | **Percent of Program Achieving Target** | 83% |
| **Methods**  | Students are required to do both hypothesis testing and confidence interval (alpha-level 10%, 5%, and 1%) to answer two questions: a) Is the action movie’s rating higher than the average rating? b) Is students’ rating lower than the average rating? All six students in the class were assessed according to the rubric O2.  |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| **Results**: : All the results are expected. Python program was used in CS 555. Data input, output, and pre-processing were examined in relation to the certificate learning outcome.**Conclusions**: All the datasets used in this course contain thousands of data instances with multiple features, and the assessment methods work. No change is needed.**Plans for Next Assessment Cycle**: This outcome will be assessed when CS 555 is offered next time. |

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| **Program Student Learning Outcome 3** |
| **Program Student Learning Outcome**  | **Understand the statistical approaches taken when dealing with multiple variables.** |
| **Measurement Instrument 1** | **Build a relationship between independent and dependent variables with the tree-based model. Evaluate the selected model.** |
| **Criteria for Student Success** | Students achieve an intermediate or higher level. |
| **Program Success Target for this Measurement** | 80% | **Percent of Program Achieving Target** | 100% |
| **Methods**  | A dataset of air pollution is provided, and the task is to predict the level of concentration of particle pollution. Students are required to build a tree-based machine-learning model using PM10, CO, sulfur oxides, and nitrogen oxides to predict the level of PM2.5. Students are allowed to use open-source libraries, such as scikit-learn. Students discuss the performance of the selected method and display their results in plots. All six students in the class were assessed according to the rubric O3. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| **Results**: : All the results are expected. Python program was used in CS 555. Data input, output, and pre-processing were examined in relation to the certificate learning outcome.**Conclusions**: All the datasets used in this course contain thousands of data instances with multiple features, and the assessment methods work. No change is needed.**Plans for Next Assessment Cycle**: This outcome will be assessed when CS 555 is offered next time. |

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| **Program Student Learning Outcome 4** |
| **Program Student Learning Outcome**  | **Combine domain expertise with programming and statistical skills to analyze large domain‐specific datasets** |
| **Measurement Instrument 1** | Compare two machine learning algorithms in terms of algorithmic performance. |
| **Criteria for Student Success** | Students achieve an intermediate or higher level. |
| **Program Success Target for this Measurement** | 80% | **Percent of Program Achieving Target** | 100% |
| **Methods**  | A dataset of air pollution is provided, and the task is to predict the level of concentration of particle pollution. Students are required to build two machine-learning models using PM10, CO, sulfur oxides, and nitrogen oxides to predict the level of PM2.5. In the report, students compare the performance of the selected methods in terms of MAE (Mean Absolute Error ), RMSE (Root Mean Square Error), ROC (Receiver operating characteristic )and display their results in plots. All six students in the class were assessed according to the rubric O4. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.** | **[x]  Met** | **[ ]  Not Met** |
| **Results, Conclusion, and Plans for Next Assessment Cycle (Describe what worked, what didn’t, and plan going forward)** |
| **Results**: : All the results are expected. Python program was used in CS 555. Data input, output, and pre-processing were examined in relation to the certificate learning outcome.**Conclusions**: All the datasets used in this course contain thousands of data instances with multiple features, and the assessment methods work. No change is needed.**Plans for Next Assessment Cycle**: This outcome will be assessed when CS 555 is offered next time. |

