Undergraduate Research Symposium May 19, 2017 Mary Gates Hall

Online Proceedings

POSTER SESSION 1

Commons West, Easel 1

11:00 AM to 1:00 PM

Transitioning into Higher Education: A Data Driven Investigation on Freshman Interest Groups at the University of Washington

Joshua Noah Malters, Senior, Informatics: Data Science
Casey Lee, Senior, Informatics
Gianni Mancinelli, Senior, Informatics
Mentor: Amirah Majid, The Information School
Mentor: Lovenoor Aulck, iSchool
Mentor: Jevin West, Information School

The First-Year Interest Group (FIG) program at the University of Washington (UW) is a variant of University First Year Seminars (FYSs), which are found at nearly all accredited four-year US colleges and universities. FYSs are believed to boost social cohesion, support knowledge acquisition, and introduce first-year students to the breadth of academic choices available to them at the host institution. At the UW, the FIG program began in the early 1980s, and has grown to involve roughly half of all entering freshmen. Despite the widespread implementation of FYSs at universities, little research has been done to measure the efficacy of these programs. This study leverages UW registrar data (including transcript records and demographic information) on over 60,000 UW freshmen across 13 years to examine the performance of FIG and non-FIG students (as measured by graduation, retention, and grades) through econometrics-based analyses of transcript records. To supplement this quantitative analysis, we use text-mining/NLP on 6 years of FIG exit survey data consisting of the responses of 14,000 students to questions regarding their FIG experiences. Our objective in our work is to use UW student information to conduct a thorough audit of the FIG experience and its effects on first-year student performance and retention. We hypothesize that students who take FYSs have a unique academic experience that is reflected in their academic outcomes as well as social integration to campus. We hope our results will motivate further discussion on current practices around FYS both at UW and across the country, while providing quantitative evidence of their impact on students' academic progression.

POSTER SESSION 2

Commons West, Easel 4

1:00 PM to 2:30 PM

VizioMetrics: Evaluating the Importance of Visual Content in Scientific Literature

Olga (Lia) Kazakova, Senior, Informatics, Computer Science
Mentor: Jevin West, Information School
Mentor: Po-shen Lee, Electrical Engineering

Viziometrics is an image search engine and classifier created by researchers at the University of Washington eScience Institute. Its purpose is to further the communication of scientific results through increased access to visual information as well as study the relationship the use of visual information and between scientific impact. Currently the search and classification are performed on 8 million images from PubMed Central, a major research database for scholarly works in the life sciences and biomedical fields. As a part of continuous efforts to improve the Viziometrics platform, we are working on a feature that automatically identifies a 'central figure' in a scientific publication. We have defined the central figure as either the visualization that encapsulates key aspects of a scientific publication, or that which best represents the research findings. In order to improve the underlying central figure search algorithm we are conducting a study that answers the question: which image, if any, do authors themselves identify as a "central figure" within a given publication? The research presented here is based on a survey of authors, whose email contacts can be found in the PubMed database. Based on the survey data, we are looking for common features characterizing papers for which authors were able to find 'central figures', as well as those for which authors could not make a decision. We are using this data to increase the accuracy of the Viziometrics algorithm. As more data sets are added to the Viziometrics platform, we hope to encourage scientists to find new ways to collaborate and communicate across disciplines.

SESSION 2H

SUPPORTING STUDENT GROWTH FROM HIGH SCHOOL THROUGH THE UNIVERSITY

Session Moderator: Walter Andrews, Near Eastern Languages and Civilization

MGH 251

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Examining STEM Curricula: Exploring STEM Major Attrition through Student Transcript Data

Siying (Lysia) Li, Senior, Informatics: Data Science
Peter Lu, Senior, Informatics: Data Science
Rohan Aras, Senior, Informatics: Data Science, Community, Environment, & Planning, Mathematics
Coulter Thomas (Coulter) L'heureux, Senior, Informatics: Data Science
Mentor: Jevin West, Information School
Mentor: Lovenoor Aulck, iSchool

The U.S is projected to face a shortage of a million graduates in STEM fields by 2022 according to the President's Council of Advisers on Science and Technology. Much of this is the result of the current attrition rate from university STEM programs. Only half of all students entering the university intending to major in STEM fields graduate with a STEM degree. Decreasing this attrition rate by just 20% (or by 10 percentage points from 50% to 40%) will address over three quarters of this million-individual STEM gap. Therefore, it is of great interest to study the systemic factors that influence STEM attrition. This study will contribute to the existing body of knowledge on STEM attrition by studying the trajectory of students into and out of STEM fields by examining transcript records for every undergraduate student at the University of Washington from 1998 to 2007. As a first step, we will build a model that intuits students' intended majors by calculating affinity scores based on prerequisite classes taken by students. Examining changes in these affinity scores over time will allow for the identification of inflection points where a student's interests are likely changing. With this information, we can identify when students change fields of study and, on a broader level, also identify when they transition away from STEM fields. We hope to then use a supervised machine learning model to identify the features of students' transcript records that predict if and when this attrition will occur. Ultimately, we hope this information will help inform institutional strategy to improve STEM curriculum design, resource allocation, and retention strategies.

POSTER SESSION 3

MGH 241, Easel 163

2:30 PM to 4:00 PM

The Role of Inflammasomes in THP-1 Cell Cytosolic Detection of Bacterial Motifs

Yva Nyhammer, Senior, International Studies, Medical Laboratory Science
Mentor: T. Eoin West, Medicine

Inflammasomes are one of the key components of the innate immune system. They sense pathogen-associated molecular patterns (PAMPs) in the cytosol of the cell and are responsible for the activation of caspase-1 to induce processing of the inflammatory cytokine IL-1β and pyroptosis. Activation of caspase-1 cleaves pro-IL-1β to its active form, IL-1β. Pyroptosis is programmed and inflammatory cell death that occurs upon intracellular pathogen infection. Pyroptosis can be triggered by the cytosolic detection of lipopolysaccharides (LPS) and their main toxic component, lipid A, which are large molecules found on the outer membrane of gram negative bacteria. LPS and lipid A are also detected by Toll-like receptor 4 (TLR4) on the membranes of immune cells. To further characterize the function of inflammasomes, we transfected human monocytic THP-1 cells with LPS and lipid A to deliver these components to the cytosol. We then quantified the inflammatory response of the cells by quantifying IL-1β and pyroptosis. To quantify IL-1β, we performed ELISA in cell supernatants. To quantify pyroptosis, we measured release of lactate dehydrogenase (LDH), a cytosolic enzyme that is released upon cell lysis. We found that – in contrast to simple stimulation of the cell with LPS or lipid A – delivery of LPS and lipid A to the cell cytosol induced IL-1β release and pyroptosis, suggesting caspase-1-dependent inflammasome activation. In addition, we found that different transfection reagents were variably cytotoxic. Future experiments will investigate whether delivery of other bacterial PAMPs, such as flagellin or TLR2 agonists, to the cytosol activates a similar inflammasome response as LPS/lipid A. Our findings will have important implications in understanding the immune response to bacterial infections and could help to develop more effective treatments.