UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 17, 2013 Mary Gates Hall

Online Proceedings

Session 1M

Critical Considerations of Technology and Media

Session Moderator: Ellen Moore, School of Interdisciplinary Arts & Sciences
284 MGH
1:15 PM to 2:45 PM
* Note: Titles in order of presentation.

Writing *Deathwatch*: Exploring the Romantic Gothic Genre Through Intertextuality
Ariana Scott-Zechlin, Senior, Creative Writing, University of Puget Sound
Mentor: Priti Joshi, English, University of Puget Sound

While writing the first quarter of a Gothic fantasy novel titled *Deathwatch*, I also carried out analytical research examining Romantic Gothic themes appearing in my creative text. I was largely unfamiliar with Gothic literature while planning this novel and these themes appeared naturally in my text from the start as a clear example of intertextuality. However, in order to gain a better understanding of the tradition I was referencing and use it effectively as a framework, I began researching features of Romantic Gothic literature. Key to Romantic Gothic literature is its villain-hero model of the outcast who is unable to determine whether his alienation is his own fault or the fault of the larger world. This model in turn leads to the Gothic features of doubles and the dangerous lover, both of which allow the hero frightening insight through physical confrontation with his own self. By identifying these literary themes in both Mary Shelley's *Frankenstein* and my own work over the course of my research, I was able to better understand and deepen my own intertextual framework. As a result, during *Deathwatch's* writing process, I was able to both reference and alter these unique features of the Gothic genre in a knowledgeable way, significantly enriching the quality of my own text.

Session 2G

Micro- and Nano-Materials in Action

Session Moderator: John Berg, Chemical Engineering
242 MGH
3:45 PM to 5:15 PM
* Note: Titles in order of presentation.

Battery-Free Gas Sensor Nodes Utilizing Ambient Radio Frequency Energy
Chen Shi, Senior, Bioengineering, Electrical Engineering
Mary Gates Scholar
Mentor: Joshua Smith, Computer Science & Engineering, Electrical Engineering
Mentor: Aaron Parks

Gas sensors are widely used in daily life and industry. An important application of gas sensing is the monitoring of environmental factors affecting health, such as the concentration of carbon monoxide, in populated areas. However, most conventional gas sensors are powered by batteries, which need periodic replacement. The goal of this project is to integrate a Wireless Ambient Radio Power (WARP) energy harvesting platform with a new class of amperometric electrochemical gas sensors, provided by KWJ Engineering, Inc, to create novel battery-free gas sensor nodes. The WARP sensing platform, developed in Dr. Joshua Smith's group, utilizes ambient radio frequency (RF) energy from common sources such as cellular towers and TV broadcast stations, which provide a reliable and pervasive 24-hour power source. The gas sensors manufactured by KWJ Engineering possess the advantages of low power, low cost, high sensitivity, and high selectivity. Particularly, the low power requirements of the gas sensors make it possible for them to be powered by the RF energy harvested by the WARP platform. Currently the potentiostat circuit needed to properly bias the gas sensor and acquire the gas concentration is being developed. The gas sensor circuitry will be integrated with the WARP platform to produce the battery-free RF-powered gas sensor nodes, followed by system optimization for reliable and efficient operations. With such gas sensor nodes, long-lived wireless sensor networks with zero maintenance cost could be deployed in continuous toxic gas monitoring applications, including air quality monitoring in cities and process control in industry.

POSTER SESSION 3

Balcony, Easel 110

2:30 PM to 4:00 PM

Identification of Spectral Endmembers in CRISM Data Using Factor Analysis and Target Transformation

Nancy Helen (Nancy) Thomas, Senior, Astronomy, Physics
Mary Gates Scholar, NASA Space Grant Scholar
Mentor: Joshua Bandfield, Earth And Space Sciences

Orbital spectroscopy provides evidence for the presence of liquid water throughout the history of Mars through analysis of the surface composition. In order to determine surface mineralogy, we use remotely sensed visible/near-infrared spectroscopic data from the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on board the Mars Reconnaissance Orbiter. We identify minerals by their unique absorptions at specific wavelengths through the examination of CRISM surface reflectance data across 438 wavelengths from 1.0 to 3.9 microns. Spectral datasets like CRISM contain large volumes of data and each spectrum usually covers an area that contains several unique compositions, or spectral endmembers. Factor analysis uses a set of mixed spectra to derive a set of orthogonal eigenvectors and associated eigenvalues. Although physically meaningless, the eigenvectors and eigenvalues can then be used to estimate the number of components present in a mixed system. Target transformation is used to reconstruct endmember spectra using a linear combination of the set of eigenvectors, even if those pure endmembers do not exist in the original data. In practice, the target transformation test is simply a least squares fit of the significant eigenvectors to laboratory spectra. If a laboratory spectrum can be closely matched, then it is a possible endmember present in the system. This methodology can also be used to remove noise and significantly improve the quality of CRISM data. We tested our methodology using CRISM data containing evidence for the presence of carbonates. Target transformation clearly confirmed the presence of Mg-rich carbonates and phyllosilicates in Nili Fossae, a series of extensional faults. We are automating this technique and applying this methodology to test for a variety of minerals across the entire planet. Ultimately, by applying our data analysis technique to the global CRISM dataset, we will have a more detailed understanding of surface composition and aqueous processes on Mars.