UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

Online Proceedings

Poster Session 2

MGH 241, Easel 128

1:00 PM to 2:30 PM

CoreView: A Novel Histology System that Rapidly Assesses Core Needle Biopsies to Modernize Pathology

David Cooper, Senior, Bioengineering
Mentor: Eric Seibel, Mechanical Engineering
Mentor: Mark Fauver, Mechanical Engineering

My research has worked to develop an automated system that utilizes techniques that will modernize pathology and reduce diagnosis times from days to hours. The current method of diagnosing cancer (histopathology) requires a tissue biopsy that is fixed with formalin for 6-72 hours, dehydrated and embedded with wax, then manually sectioned, mounted on slides, and stained for imaging. This manual process is extremely time and labor-intensive and is the reason diagnoses can take up to ten days. The preferred, and least invasive, way to obtain tissue from a patient is the core needle biopsy (CNB), which is taken by inserting a needle into a region where cancer is suspected to exist, and removing a cylindrical section of tissue. Although CNBs are rapidly becoming the standard-of-care, their small diameters make it difficult to prepare and section the tissue for use in conventional histopathology. My research project over the past year has been to develop CoreView, a device designed to handle CNBs, automatically staining and imaging their entire surface for more complete images used to diagnose cancer. We use deep ultraviolet light to image the outer 2-3 cell layers of fluorescently stained tissue in a lab-built microscope to produce sharp images that can be equivalent to standard histology images from thin sections. I used LabVIEW to develop the rotational and imaging control to image the tissue at different focal points so the biopsy surface stays in focus during rotation. Along with designing necessary components of our system, I have worked on improving processing techniques for staining fixed porcine liver to produce clearer images with high contrast between the nuclei and the cytoplasm/cell boundaries. Our collaborating pathologist has confirmed that these images are at diagnostic quality, proving that CoreView and my improved techniques for processing tissue have the opportunity to revolutionize current histopathology.

Session 2O

Economic Issues

Session Moderator: Michelle Turnovsky, Economics

MGH 389

3:30 PM to 5:15 PM

* Note: Titles in order of presentation.

Extending a Theoretical Framework for Superfund Site Remediation

Cameron Raber, Senior, Mathematics, Economics, Pacific Lutheran University
Mentor: Lynn Hunnicutt, Economics, Pacific Lutheran University
Mentor: Mark Reiman, Economics, Pacific Lutheran Universithy

The environmental and human health damage associated with industrial waste has been an undeniable concern since the late 20th century environmental disaster at Love Canal, which had devastating effects on birth defect and miscarriage rates. Since this event, the Environmental Protection Agency (EPA) has been dedicated to the remediation of toxic waste through the Superfund program. There are Superfund sites across the country, in locations as varied as urban Tacoma, Washington and rural Evansville, Wyoming. Which toxic site should enjoy the advantages of faster cleanup? A range of factors could influence the remediation rate at these sites, yet a striking difference in site characteristics presents itself; These two sites are home to very different population densities. Population density, an emblematic proxy variable, can be used as an effective tool to investigate different aspects of socioeconomic site characteristics. Scholarly models of optimal remediation, however, often focus exclusively on the financial costs and environmental damage of cleanup. This project investigates how Superfund site remediation would change if the EPA were to incorporate specific socioeconomic criteria in its decision to remediate toxic sites. Particularly, it explores various aspects of the Superfund program and focuses on and extends a particular theoretical model for temporal remediation. Population density enters the model through its effects on costs, although other consequences of population density will be investigated. The results of the extension indicate that a higher population density corresponds to a decrease in the optimal toxic waste cleanup rate.

POSTER SESSION 3

MGH 241, Easel 130

2:30 PM to 4:00 PM

Silicion Isolation

Stephanie Tram Sin, Junior, Physics: Applied Physics
Mentor: Mark Brunson, Washington Nanofabrication Facility
Mentor: Karl F. Bohringer, Electrical Engineering

Isolation of silicon (Si) is a microfabrication technique used to isolate selected areas of silicon from interacting with each other using silicon dioxide (SiO2). This processes is done to separate metal oxide semiconductor (MOS) transistors from each other. MOS is a specific way of fabricating devices that is low cost and easy to integrate. It is a very important step in creating integrated circuits. Circuits must be isolated from each other to perform correctly. The smaller the space to separate the circuits, the more circuits can be placed on a device or the smaller the device can be. There are currently two different techniques for isolating silicon. Local Oxidation of Silicon (LOCOS) is the more widely used technique versus the more modern attempt, Shallow Trench Isolation (STI) that is becoming more popular this decade but has many more process steps. Each technique has its pros and cons. LOCOS is a method in which a thin layer of SiO2 is deposited on a wafer, pad oxide, and then a layer of silicon nitride (SiN) is also then deposited as an etch barrier for later stages.Through photolithography processes, including photoresist application, aligning and exposure, a pattern is transferred onto the wafer. The wafer is then put through a plasma etcher to create space for more oxide. Next is for the thermal oxide to be grown, creating an unfortunate "birds beak" that limits feature size of the circuit . The final step is the removal of the remaining nitride and only oxide is left. I am creating a completely new process flow along with a new wafer mask for photolithography to cater to the labs existing equipment, varying different variables and attempting to optimize the technique for the lab. In doing so I will be our lab's capabilities are tested to see how efficient it is to run the process in the facility and how accurate the results are. The results will be used to determine if in the future certain design features will be able to be implemented in and then fabricated in the lab. Also the question of the techniques viability is answered, if it is still usable and in tolerance with different standards.

POSTER SESSION 3

MGH 241, Easel 131

2:30 PM to 4:00 PM

Silicon-Oxide Hard Mask Selectivity for Through Wafer Etch Application

Ryan Van Der Hoeven, Junior, Materials Science & Engineering
UW Honors Program
Robert Henri Biegaj, Senior, Physics: Applied Physics
Camila Hashimoto (Camila) Kang, Sophomore, Engineering Undeclared
Mentor: Mark Morgan, EE, Washington Nanofabrication Facility
Mentor: Karl F. Bohringer, Electrical Engineering

Deep reactive-ion etching (DRIE) is a highly anisotropic etch used for creating high aspect ratio and steep sidewall etch features in silicon wafers. The etch characteristics of DRIE are desirable for a variety of microelectromechanical systems (MEMS) applications such as through silicon vias for integrated 3 dimensional circuits and MEMS based microneedles. A common problem while trying to etch smaller features using DRIE is that the difficulty of transporting etch gasses and etch byproducts in and out of the deep trenches decreases silicon etch rates. This causes the silicon-to-mask selectivity to decrease with feature size as the etch rate for silicon decreases while the etch rate for the photoresist mask remains unchanged. By manipulating the process variables (including pressure, deposition/etch times, and temperature) and using an oxide hard mask instead of photoresist, we intend to improve the selectivity for DRIE etches of smaller features. Standard recipes are used to deposit a uniform oxide layer on the wafer, then a photoresist mask is used to etch through the deposited oxide. After stripping the photoresist mask, an oxide hard-mask is left patterned on the wafer. The silicon wafers are then etched using the SPTS-DRIE & Oxford-DRIE tools, which utilize alternating steps of C4F8 passivation and SF6 etching, known as the Bosch process, to create the high aspect ratio trenches. The scanning electron microscope (SEM) will be used to characterize the depths and sidewall profiles of trenches containing features of all sizes, while a profilometer will be used to find the depths of large-featured trench depths. Additionally, the SEM will be employed to determine differences in sidewall topography compared to topography achieved with photoresist. The goal is to obtain an etch profile with high selectivity using oxide hard masks, while still maintaining sidewalls close to 90 and typical etch characteristics.

POSTER SESSION 4

MGH 241, Easel 142

4:00 PM to 6:00 PM

Do Conflicts Make English Wikipedia Better?

Jessica Arlene Prasetyo, Sophomore, Pre-Major (Arts & Sciences)
UW Honors Program
Stephanie Wong, Junior, Pre-Sciences
Nick Zhou, Sophomore, Pre Engineering
Avery Wolf, Sophomore, Pre-Social Sciences
Diana Victoria (Diana) Davidson, Sophomore, Pre-Humanities
Madison Mackenzie (Madison) Johnstone, Sophomore, Pre-Major (Arts & Sciences)
Mentor: Taryn Bipat
Mentor: David McDonald, Human Centered Design & Engineering
Mentor: Mark Zachry, Human Centered Design & Engineering

The English language Wikipedia is notable for its large number of articles. The development of this online encyclopedia would not be possible without the intricate interactions of editors that help sustain the virtual collaborative platform. Editors have a role in creating and reshaping articles and therefore have a role in how Wikipedia evolves over time. Our study replicates a qualitative coding scheme created over 12 years ago that demonstrates that policy and power play a role in mass collaboration. The prior work shows that user interactions including collaboration, conflict, coercion, and consensus have influenced changes on Wikipedia articles. A team of researchers are currently working to replicate this qualitative coding scheme on English Wikipedia talk pages to understand how these different types of user interactions occur in current editor discussions around article construction. Our findings will help contribute to a deeper understanding of how power plays between users have changed since the initial study. Our preliminary results, show that editor debates often lead to questions around article scope and legitimacy of sources. Furthermore, while policies play a large role in article building, editors own opinions influence how editing occurs.

POSTER SESSION 4

MGH 241, Easel 143

4:00 PM to 6:00 PM

How Do Editor Interactions Help Build the French Language Wikipedia?

Christopher Alexander Moreno, Junior, Pre-Sciences
Ethan Thomas Walkley, Senior, French, Human Centered Design & Engineering
UW Honors Program
Avery Pong, Senior, Biochemistry
UW Honors Program
Jade D'souza, Freshman, Pre-Sciences
Andrew Trevor Briand, Junior, Computer Science
Mentor: Taryn Bipat
Mentor: Mark Zachry, Human Centered Design & Engineering
Mentor: David McDonald, Human Centered Design & Engineering

Have you ever had to motivate the team? What was the result? The English language Wikipedia is notable for its large number of articles. However, 288 other active language editions of Wikipedia have also developed through the intricate interactions of contributing editors. While the editor interactions in the English Wikipedia have been researched extensively, these other language editions remain understudied. To understand how editors currently come to consensus in article building in the French language, a team of researchers has leveraged an existing English framework that depicts how power and policies play a role in mass collaboration. Using this English language framework, we are using qualitative coding methods to build a unique model of the editor interactions on the French language Wikipedia. The results of this study will help contribute to a deeper understanding of how a framework in a different language edition of Wikipedia differs from the English. Our preliminary results show that policy plays a large role in justifying editor decisions for the edits they make on various articles. Furthermore, our research findings have expanded our knowledge of the issues surrounding replication of an English framework in a different language platform.