Poster Session 1

Commons East, Easel 77

11:00 AM to 12:30 PM

A Web Study Evaluating Low Frame Rates and Bitrates for Mobile Sign Language Video

Rafael Torres (Sunny) Rodriguez, Senior, Electrical Engineering
Mary Gates Scholar
Mentor: Eve Riskin, Electrical Engineering
Mentor: Jessica Tran, Electrical Engineering

Mobile video communication has been popularized by applications such as Skype and Facetime, but the technology suffers from resource limitations both on the device and on the cellular network. Transmitting high quality video requires high bandwidth and battery draining processing power on mobile devices. These requirements hurt the user experience by creating high data cost, reducing call time, and limiting use to high speed networks such as WiFi. My research contributes to the MobileASL (American Sign Language) project that applies video compression to solve these issues specifically for mobile sign language communication. The deaf and hard-of-hearing community can benefit immensely from a mobile video chat application as ASL is a visual form of communication. We conducted a web study investigating sign language comprehension and intelligibility of video transmitted at four low frame rates (1, 5, 10, 15 fps) and four low bitrates (15, 30, 60, 120 kbps). The purpose was to determine how much video quality can be reduced before compromising sign language comprehension and intelligibility. The study found intelligible sign language video can be transmitted at frame rates and bitrates much lower than the current recommended standard for sign language video communication (25 fps at 100 kbps or higher) without diminishing the user experience. These findings strongly suggest that the recommended international standards are too high and can be reduced while maintaining intelligibility.

Poster Session 1

Commons East, Easel 67

11:00 AM to 12:30 PM

Mitochondrial Mutagenesis in Colon Cancer Cells Induced by Fluorodeoxyuridine and O4-ethyldeoxythymidine

Katherine Elizabeth (Katie) Jackson, Sophomore, Aquatic & Fishery Sciences
Mentor: Lawrence Loeb, Pathology
Mentor: Jessica Kuong, Pathology

Fluorodeoxyuridine, FUDR, is a widely used treatment for many different types of cancer. It starves cells of deoxythymidine triphosphate, dTTP, which causes an imbalance in the deoxyribonucleotide, dNTP, pool sizes in the cell during DNA replication. We are predicting that with a lack of dTTP, the DNA polymerase sometimes will substitute an incorrect nucleotide in place of dTTP causing mutations, and we believe that this will affect the number of mutations in the mitochondrial genome. To study this, we are using combinations of FUDR and O4-ethyldeoxythymidine (O4-EtdT). This second mutagen, a modification of Thymidine, is used during the salvage pathway for the synthesis of dTTP. It can compete with dTTP and causes a loss in specificity for the DNA polymerase during further rounds of replication. We are treating colon cancer cells with combinations of these mutagens and using the random mutation capture (RMC) assay to quantify the mutations in the mitochondrial genome. The mutations are enriched with a restriction enzyme that cleaves the wild type DNA leaving only mutated DNA to be amplified using qPCR. We are then using TOPO cloning to sequence the mutations. Many believe that uracil will be used as substitute when the cell is starved of thymine because of their similar structures. However, incorporation of uracil will not result in mutagenesis, while incorporation of the other three nucleotides will. With the results from TOPO cloning, we will be able to take a closer look at this hypothesis. Further on, results will be analyzed using the Student T-Test and One Way ANOVA. So far, the data shows a change in the quantity of mutations in mitochondrial DNA when either O4-EtdT or FUDR are added. Results can help us to understand and respond to post-chemotherapy health problems that may be due to mutations in the mitochondrial genome.

Poster Session 1

Commons East, Easel 79

11:00 AM to 12:30 PM

Using Inexpensive Temperature Sensors to Estimate Incoming Radiation and Snow Surface Albedo

Adam Massmann, Junior, Civil Engineering
Mary Gates Scholar
Mentor: Jessica Lundquist, Civil And Environmental Engineering
Mentor: Mark Raleigh, Civil and Environmental Engineering

Over one sixth of the world's population, including 60 million people in the western United States, depends on snowpack for their primary source of water. Water resource managers use snow models to help quantify the amount of water stored as snow. Many modern models explicitly quantify how various methods of energy transfer affect snow ablation but are limited by a lack of in-situ observations for some forms of energy transfer. In particular, measurements of incoming radiation (one of the dominant sources of snow melt in many climates) and snow albedo (the fraction of solar radiation reflected by snow) are scarce due to the high cost of radiometers and the difficulties of obtaining quality measurements in mountainous terrain. Sensor windows are easily covered by heavy snowfall and require frequent maintenance. In contrast, small, inexpensive temperature sensors require minimum maintenance and are far less likely to be covered by snow. Their low cost and ease of installation allow for far greater numbers of observations. Because of this, we are exploring new methods of estimating radiation and albedo by deploying groups of temperature sensors purposefully shaded in different ways. Each group has one temperature sensor shaded from all radiation, one sensor shaded from downwelling radiation, and one sensor exposed to radiation from all directions. We hope to develop a reliable, inexpensive, and accurate method for calculating radiation and snow albedo from the difference in temperature readings between each sensor. Observed radiation at each study site will be used to engineer and validate the method. One year of measurements at Tuolmne Meadows, CA has been recorded and another recent installation at Snoqualmie Pass, WA provides additional data to include in our study.

POSTER SESSION 4

Balcony, Easel 97

4:15 PM to 5:45 PM

Firn Model Inter-Comparison

William Procter (Will) Leahy, Senior, Interdisciplinary Visual Arts
NASA Space Grant Scholar
Mentor: Edwin Waddington, Earth And Space Sciences
Mentor: Jessica Lundin, Earth and Space Sciences
Mentor: Max Stevens, Earth and Space Sciences

Our 800,000-year climate record is dependent primarily on data obtained from ice cores. Analyzing and dating the ice, gas, and sediment in these cores allows us to construct a remarkably accurate historical record of Earth's climate and atmosphere. However, the dating and chronology of the ice record is not as exact as we would like it to be, especially deeper in the ice. Our ability to date ice cores with accuracy depends on our understanding the evolution of glacial firn, fallen snow that gradually compacts into ice. Researchers have developed many different models of firn evolution. The aim of this project is to run these models against each other under the same boundary conditions, so that we may compare their responses and determine the strengths of each model. Participants have submitted their model output and our results have been returned to them. A second inter-comparison will be organized to address issues brought up by our initial results. These comparisons will improve future efforts in firn-modeling, ultimately leading to a better understanding of our climate record.

POSTER SESSION 4

Balcony, Easel 86

4:15 PM to 5:45 PM

A Web-Based Community Firn Model

Paul Daniel (Paul) Harris, Senior, Applied & Computational Mathematical Sciences (Scientific Computing & Numerical Algorithms)
Mentor: Edwin Waddington, Earth And Space Sciences
Mentor: Jessica Lundin, Earth and Space Sciences
Mentor: Max Stevens, Earth and Space Sciences

The distribution of temperature and precipitation on our planet (i.e. our climate), affects plant growth, animal habitats, and the livability of Earth's varied regions. In order to predict future climate we need to know about our past climate. This is important to better understand how temperature and weather conditions change when the radiative forcing (e.g. CO2 greenhouse effect) on our atmosphere increases. The best way to predict these changes is researching past radiative forcing increases and how these events impacted Earth's climate. Some details of our past climate are discovered by analyzing polar ice and the gas bubbles trapped within. Firn is fallen snow that compacts and eventually turns into glacial ice. During this process gas can move relatively freely throughout the firn. When the firn densifies enough to block the air passageways, young gases are trapped in significantly older ice. This work is building a web-based community firn densification model that allows the user to accurately determine the difference between the age of a gas sample and the age of the ice surrounding it. Our transient model determines this delta age more accurately than current steady-state models by accounting for changing conditions as the firn turns into ice, instead of assuming conditions remain static throughout the firn evolution. This model is open-source, and written using the Python programming language, along with the NumPy library, allowing the model to be free and usable by anyone. Because the model is modular, users can easily change it to fit specific conditions or to incorporate different physical processes. Our goal is to provide a model that is simple to use, freely available, and helpful for developing a more accurate understanding of our past climate.

Poster Session 4

Commons East, Easel 45

4:15 PM to 5:45 PM

The Effects of Modifying IAA28 Degradation Rate in Lateral Root Formation in *Arabidopsis thaliana*

Autumn M. (Autumn) Walker, Senior, Biology (General)
Mary Gates Scholar
Mentor: Jennifer Nemhauser, Biology
Mentor: Jessica Guseman, Biology

Essentially all growth and developmental processes in plants require action of the hormone auxin. Auxin regulates gene expression by mediating the degradation of repressor proteins called IAAs. A subset of IAA proteins are involved in the initiation of new lateral roots, which are important for overall root architecture and function. Members of the Nemhauser lab have shown that proteins within this subset from *Arabidopsis thaliana* have varying auxin-induced degradation rates, using degradation assays in a heterologous yeast system. I hypothesize that differences observed between the degradation rates of the IAAs contribute to the specificity and diversity of auxin responses. When one of these lateral-root expressed IAA genes, IAA28, is mutated so that it is completely unable to be degraded, the plant does not form lateral roots. I predict that small changes to the degradation rate of IAA28 will lead to differences in plant phenotype, specifically the developmental stages and numbers of lateral roots that develop, as is suggested by preliminary data from work with IAA14. Currently, I am engineering and testing modified versions of IAA28 with the goal of obtaining a range of degradation rates. It is difficult using plant-based system to measure the degradation rates of modified IAA28 proteins due to feedback and the inability to control auxin. To test the degradation rates of modified versions of IAA28, I am expressing them in the yeast, *Saccharomyces cerevisiae*. Once I have obtained a cohort of modified IAA28 proteins that display a range of degradation rates, I will transform these proteins into plants. I predict that my observations of plant phenotypes will allow me to determine whether the precision of IAA28 degradation rates matters. The results of my research may partially explain the importance of the differences between IAA degradation rates in determining specificity of auxin response phenotypes in the plant.