Bridging Real-Time NDN-CXX Based Applications with the Named-Data Network Simulator
Erick Quintanilla, Alex Afanasyev, Spyridon Mastorakis, Yingdi Yu, Lixia Zhang

Unlike the current Internet, NamedData Networking (NDN) is a format that is built to handle and manage today’s large demand of data transactions. In order to examine and test the robustness and versatility of NDN, researchers of the Internet Research Laboratory at UCLA created a simulator called ndnSIM. What the simulator currently lacks is a method of emulating real-time applications that are constructed with an NDN foundation, which is why this project is a priority for continuing the growth and expansion of NDN. The task at hand involves creating a bridge between the various NDN-based applications and the simulator itself.

Cloud-based Autonomous Cooperative Vehicle Control System

Recent advances in computing and embedded sensing have given rise to autonomous vehicle technology. If current trends continue, by the year 2044, envisioning a country where the majority of vehicles on the road are autonomous will be very feasible. This will eventually pose a serious computational challenge to the average embedded vehicle computer, which will be responsible for an increasingly greater number of decisions, all of which will be uninformed by, and independent of, other vehicles.

Instead, we envision a new system that aims to exploit the Internet of Things paradigm in order to make decision-making amongst autonomous vehicles cooperative via cloud communication. We first outline a simple node based vehicle control algorithm, and then detail a prototype design of an autonomous vehicle control and navigation system using a cloud server and several RC cars embedded with Intel Edison microprocessors and a network of sensors, and discuss our progress in implementing this system.

We further demonstrate possible benefits of this system by placing obstacles within a map and demonstrating cooperative obstacle avoidance and path planning in order to find unencumbered paths for each vehicle. We conclude by comparing this system to modern GPS and evaluating benefits of our system on a real-world scale.

Composition – Stiffness Relationship in Silicate Glasses
Zin Win (Sandra) Maw, Bu Wang, Yingtian Yu, Mathieu Bauchy

In modern society, glass has become essential for touch-screen devices, fiber optics and television screens because of its strength and transparency. Nonetheless, stronger glasses are yet to be discovered and thus, we need to first understand the relationship between the compositions and the mechanical properties. Calcium aluminosilicate, a very commonly used material for touch-screens and television screens, is simulated using molecular dynamics and subsequently compared with experimental values. Specifically, the elastic properties were calculated, where we find molecular dynamics reproduce high level of agreement in both magnitude and slope to that of experimental data. On the contrary, conventional models resulted in having larger error than simulations did although conventional models also succeeded in reproducing same trend. From this observation, the next goal would be building more accurate model to reduce dependence on simulation, which is more time consuming than the models.

Design, Modeling, and Control of a Hydrostatic Actuator for MRI
Francisco Gomez, Jonah Hephzibah, James Simonelli, Tsu-Chin Tsao

Magnetic Resonance Imaging (MRI) are widely used as a diagnosis tool with various advantages such as high soft tissue contrast, high image resolution, and a three-dimensional representation of the patient’s anatomy. Since MRI is the ideal diagnosis tool for detecting malicious tumors, designing an MRI-compatible robot for doctors to perform accurate, yet simple, biopsies can be implemented in the MRI bore. Since the robot has to have non-ferrous material, we created the frame from Polyoxymethylene (Delrin) due to Delrin’s low coefficient of friction and ease of machining the desired shape. Moreover, instead of waterjet cutting the movement arm, our team decided to 3D print the pieces due to its precise and accurate procedures. Once the prototype robot was complete, controlling the robot developed into a master-slave hydrostatic actuator by using glass syringes to transfer liquid and force from the master (actuator) to the slave (robot). Once we decided on hydrostatic actuation, the next step was motorizing...
it. The method the team took was turning rotary motion into linear motion. Therefore a simple but efficient Whit Worth mechanism was attached to a rotary motor by a timing belt. The system can now have the potential to be controlled by a doctor, alongside a radiologist, to perform quick and efficient biopsies.

Developing a Software Platform for a High Throughput, Cost-Efficient, and Portable Computer Aided Sperm Analysis (CASA) system
Chengzong Ou, Kiran Sivakumar, Steve Feng, and Aydogan Ozcan

Analysis of sperm characteristics is typically performed for animal husbandry, to analyze and resolve human conception difficulties, and to examine the result of a vasectomy operation. Initially, sperm samples were manually examined under a microscope by lab technicians to determine an individual’s sperm count, sperm motility, and sperm morphology. Computer Aided Sperm Analysis (CASA) systems were originally proposed in the 1980s to reduce labor and time cost from manual analysis. Modern CASA systems typically consist of a light microscope platform used to digitally capture images of processed sperm samples, which are sent to an attached computer for image processing to determine sperm characteristics of interest using custom-developed software. These systems, albeit accurate, can only image a subsample of the sperm inside the sample due to the reduced field-of-view from the microscope’s high magnification optics. They are fairly large, have a low throughput, and due to being reliant on lens-based methods, remains very costly. By using a lens-free imaging approach, we are developing a low-cost, high throughput, and portable CASA system. Our system consists of an imaging sensor where samples are loaded directly above the sensor in a tray, along with a LED light source directly overhead the sensor without any lenses involved. Previously, we developed a lens-free approach that replaces the light microscope platform and it was proven successful in analyzing images captured. However, the new system will be delivered with a custom developed software platform for automatically capturing images from the system, analyzing the captured images for sperm characteristics, and in displaying results to the user. The upcoming objective is to optimize the software to create a simple recommendation program for the portable device for at-home use. Alternative versions of the software that provide detailed analysis and statistics for clinical and industrial applications are also one of our future development objectives.

Energy-aware Inferencing of Rich Contexts and Behaviors
Tahiya Salam, Ryan Peterman, Chenguang Shen, Mani Srivastava

Health monitoring applications enable the collecting and recording of users’ daily fitness that may be used in primary care, rehabilitation, or self-motivation. Typical health monitoring applications exist on smartphones or dedicated hardware. Applications on smartphones require the cumbersome and easily forgotten start and stop of logging performed activities. Dedicated hardware serves only one function and contains accelerometer and gyroscope sensors already available in phones. Smartwatches offer sensing capabilities through many built-in sensors. Additionally, the computing power and unique body placement of these devices offer a novel approach to real-time health monitoring. The goal of this work is to autonomously classify rich contexts through smartwatches and display this information on a paired smartphone, thereby maximizing visual data available and smartwatch battery life. The project seeks to determine the most useful data in representing activities related to fitness tracking and the most effective classifier model in labeling such activities. Data display on the smartphone diverts memory and energy use on the smartwatch and grants the user greater access to their personal progress. Results show acceleration sensor data suffices in classification of activities. Model evaluation determined marginal differences in performances of classifiers and deemed decision tree classifiers as best due to their white-box implementation. After installation, the application consumed reasonable energy resources on both the phone and watch.

Evoked Potentials
Anida A. Len, Shengjie Bi, Ramin Ramezani, Majid Sarrafzadeh

Recently, studies have shown that patients, with some form of paralysis, have been able to regain voluntary movement. Even after an injury, the spinal cord still remains somewhat intact and functional. This leads us to believe that there is a possibility of stimulating the spinal cord to elicit movement. Electrical and/or magnetic impulses are sent down the spinal cord, below the point of injury. This results in sporadic muscle movements. The ultimate goal is to condition those certain muscles to move based upon electric and/or magnetic stimulation.

My specific area of research involves working with the resulting muscle signals. Though some muscles output very clear signals, like the deltoids, others muscles, that are farther away from the spine, give off unclear signals. There are also other factors that contribute noise, like machinery, that can obscure the data. My main task was to learn digital signal processing. This included plotting the data, filtering out any noise, and clearly displaying the evoked potentials from each stimulation, using MATLAB software. With the clean data, we hoped to find correlations between stimuli and the resulting muscle reactions, but none was apparent at this time. The reactions remain sporadic and no conclusions could be confidently drawn.
Impact of Image Format on Flash Storage Efficiency
Eduardo Chavez, Shaodi Wang, Puneet Gupta

In today’s electronic market, flash based memory device, such as Solid state drives (SSD), USB drives, micro-SD and SD card, are replacing traditional magnetic based memory (e.g. hard disk drives) due to the performance advantage of flash devices. However all flash based memory devices are subject to failure due to the endurance of a memory block. Endurance is the end-of-life parameter that vendors use to measure the maximum program-erase cycles that a memory block can afford before functional failure (i.e., a SDD may lose the stored information when its flash devices are programmed and erased more than the limit times). In this research, I was to observe a video feed, capture images in one second intervals, write a C++ program to store the image’s information into blocks, and make a linear comparison between the blocks of the adjacent images. The purpose of this method was to observe the way information was stored in memory blocks in order to discover a way to minimize the program and erase cycles which could contribute to maximizing the endurance of flash based memory devices.

Low Power Receivers
Giovanni Magana and Babak Daneshrad

Signal Processing is used to summit sound, images, or information as signals. Currently it enables us to transfer information as signals to represent techniques for modeling, recovery and analysis for applications in wireless communications. When a signal is produced a transducer converts the signal into an electrical current. The current is later processed by a transmitter into an electromagnetic wave received at a frequency by the receiver. The receiver then converts the original signal into a new frequency and finally converted by another transducer into final structure. Receivers are composed of a local oscillator along with a mixer. Both components are used to change the frequency of a signal when detected. However, receivers consume power whenever they are active; it would be most efficient to only wake up the receiver when it is needed. A dedicated low power receiver can be used to detect a series of tones needed to signal user activity within a network so that nodes can be woken up. Within this research we attempt to minimize power drawn and produce self-mixing architecture and investigations in delays within the signals.

Speaker Recognition
Rene Plowden, Scott Shi, Soo Jin Park, Abeer Alwan

The abstraction of phenomena of everyday things can be seen in modern technology. Language can be abstracted down to letters and characters that can be typed into computers that will then interpret that information and process it. Even the human can be abstracted into general shapes (eyes, nose, mouth) which machine learning algorithms can recognize and attribute to a specific person’s face. This abstraction is a process of breaking down such phenomena such as recognizing someone’s face into simpler and simpler phenomena (recognizing face à recognizing shape of eye à recognizing eyelid à etc) until it can be represented by something simple enough such that a machine can handle it. So in order to recognize speech, we need to be able to abstract the human voice into such features. My research involves finding such a method to abstract the human voice and to do that, I explored two existing methodologies: NSIM and iVector, to see if it is able to discern one speaker from another to a degree that it performs better than humans who try to discern the same speakers. The abstraction of phenomena of everyday things can be seen in modern technology. Language can be abstracted down to letters and characters that can be typed into computers that will then interpret that information and process it. Even the human can be abstracted into general shapes (eyes, nose, mouth) which machine learning algorithms can recognize and attribute to a specific person’s face. This abstraction is a process of breaking down such phenomena such as recognizing someone’s face into simpler and simpler phenomena (recognizing face à recognizing shape of eye à recognizing eyelid à etc) until it can be represented by something simple enough such that a machine can handle it. So in order to recognize speech, we need to be able to abstract the human voice into such features. My research involves finding such a method to abstract the human voice and to do that, I explored two existing methodologies: NSIM and iVector, to see if it is able to discern one speaker from another to a degree that it performs better than humans who try to discern the same speakers.

Strain Rate Behavior and Modeling of UCLA Foam
Jesse Villalobos, Brian Ramirez, Professor Vijay Gupta Ph.D.

Elastomeric foams of varying densities are of great interest for the reduction in structural damage and injuries generated by dynamic forces. However, the impact mitigation properties of foams depend largely on the rate at which the material is strained. In the present work, the stress-strain behavior of newly developed UCLA foams are investigated under low \(10^{-2}\) s and medium strain rates \(10^2\) s. Additionally, the force-time response of UCLA foams at an impact energy of 5J are compared to Finite Element simulations based on the stress-strain results previously obtained. Modeling the impact behavior of strain rate sensitive foams can be used to design new materials for emerging impact applications.
With the increase in the number of older patients with cancer in recent years, it has become important to identify these patients in an earlier time. Previous research has shown that relevant tests on an older patient's health, such as ADL (Activity of Daily Living), iADL (Instrumental Activity of Daily Living), and GUG (Get-Up-and-Go Test), can be used to identify patient with a higher potential of having cancer. To further expand on the idea of how patients’ daily activities are closely associated with their health, our research project is to design a system that uses Android wearable smart watches to constantly monitor patients’ activities and periodically send the collected information to a cloud server. Although that using wearable devices to monitor human activities has been a common method in recent years, there is still a lack of an inexpensive and efficient wearable activity monitor for the patients. Therefore, our goal for the project is to design a system that provides accurate results without requiring high expense.

Part of the work of the project and the focus of this report is to design user-friendly UI (user interface) of the watch app. Since the users of the watch are mainly frail, older patients who may not previously know how to use a smart device, the goal of the work is to keep the UI simple and easy to understand without losing important instructions and notifications. In order to obtain a more organized and sustainable application, we attempted to disable access to the watch settings such as screen brightness from the user so the battery time can stay longer. However, results of the attempts show that we are not able to disable the settings in a desired way. We suggest that the next step is to investigate other features (Screen Pinning) in Android API 5.