

**INAUGURAL COURSE PROJECT POSTER FAIR**  
**THURSDAY, JUNE 8, 2017 – 3:30-5:00 P.M.**

***Automated Program Verification and Synthesis through Domain-Specific Symbolic Compilation***

Nate Yazdani

This work presents a language with built-in support for domain-specific symbolic compilation. Classical symbolic compilation is a technique to translate the semantics of a program into a logical formula, through compositional translation of the semantics of the core language's constructs. This technique has shown significant success for automated verification and synthesis of small, simple programs, but performance quickly degrades for larger or more complex programs. Domain-specific symbolic compilation extends symbolic compilation with additional translation rules for domain-specific constructs. These domain-specific rules help overcome the scalability challenge by specializing the translation process and the resultant logical formula to the kind of constructs used by the program at hand. This language integrates these rules into the same translation pipeline as those for the core language, allowing it to enforce safe composition. This language facilitates domain-specific symbolic compilation with higher assurance and orders-of-magnitude speed-up over classical symbolic compilation.

***Cambrian - A stream based language to hack Internet of Things solutions for non-hackers***

Emerson Matson, Spencer Anderson

Cambrian is a fluent-style, reactive, domain-specific language for working on Internet of Things (IoT) projects. Cambrian provides a wide array of extendible stream structures and transformations that allow for non-hackers to easily produce clean solutions to whatever IoT problem they are tackling. The extendible design of Cambrian allows for future implementations of stream optimization, and the development of user-generated streams.

***"Chris faked being excited": Coherent Story generation with Actor State Networks***

Ryan Benmalek

While story generation has been tackled in the past in NLP, it has tended to be very discrete (operating on plot graphs or narrative templates). Recently, neural approaches, while demonstrating success, are not built to explicitly reason about actors and world state. We demonstrate a neural approach that explicitly reasons about the mental states of characters and their interactions to produce more coherent stories. In addition, we introduce a novel dataset of stories an order of magnitude larger than comparable story datasets that, due to the tonality and style of speech, is uniquely suited to this task.

***Conversational Question Generation with Sequence to Sequence Learning***

Pooja Sethi, Daniel Gorrie

Suppose you are meeting someone for the first time. You might say something like, "I go to school at the University of Washington." In response, your inquisitive companion might ask you relevant questions like "What are you studying?" or "When are you graduating?" Previous work in question generation has focused on reading comprehension and extracting question-answer pairs from source text. Our goal, however, is to generate conversational questions directed to a person, given some input statement they provide about themselves. We achieve this using a sequence to sequence model with attention, pointer mechanisms, beam search decoding, and learned GloVe embeddings. Our model is trained on two different data sets which we processed for input-question pairs: the Cornell Movies-Dialog corpus as well as a Usenet corpus. Our model achieves a BLEU score of TBD and perplexity of TBD.

## ***CoughSyrup***

Kelsie Haakenson, Tim Trindle, Clarissa Song

For the care teams of those using augmentative and alternative communication (AAC) devices, enabling their loved ones to speak requires forethought and planning. Traditional AAC devices use eye-movement trackers and pre-built boards to enable communication, but they are expensive and bulky. CoughDrop is an open source software that effectively solves this problem. However, it can still take 30-45 minutes to create a board in CoughDrop. We wanted to remove the barrier to entry for creating and editing these boards. A child should be able to talk about any topic, at any time. Technology should not hinder expression of spontaneous ideas, but facilitate it. In our project, we provided a solution where users can: (1) search for a topic to get a suggested board; (2) edit in list view easily even on mobile; and (3) import CSV files from their editor of choice to build a board. To test our prototype, we then conducted usability tests on our three features. We recorded the time it took and number of clicks the user made for the same tasks completed using existing vs. new features. The result showed a decrease in both time and the number of clicks used with our new solution.

## ***DASH***

Jiarui Guo, Melissa Khuat, Clarissa Song, Novin Changizi

Texting a friend, navigating on GPS, admiring the scenery along a road--these are all common distractions that lead to motor accidents. Distracted driving is a major issue, and many states have enacted laws in response to the alarming correlation between driver recognition error and vehicle accidents. Unfortunately, many people continue to engage in distracting behavior, even though they are aware of the dangers of unfocused driving. We are designing a movement-tracking hardware and a mobile application, DASH, that allows users to visualize and share data on driving behavior. By providing users with information on how they spend their time driving and giving sound feedback from the hardware, we can motivate them to be more conscious about road safety. The goal of our project is to track, process and visualize driving behaviors, prevent potential accidents, encourage safe driving habits through social sharing of driving safety scores.

## ***Dealsmash - Penny Auction Predictor***

Cody Ohlsen, Dylan Johnson

Prior research about penny auctions have suggest that they are unpredictable. On the contrary, we believe that informed feature selection, modern machine learning methods, and large amounts of sequential data, can be used to reliably predict the end of penny auctions. The goal of our project was to create a machine learning classifier that will output whether or not a penny auction will end on the current leading bid. We created a data collector that is capable of collecting data on millions of bids per day from DealDash.com, a popular penny auction website. We engineered features that describe auction statistics, product statistics, and user behaviors. We present the results of our optimal classifier, which can be used to make a profitable bidding agent. When a bid is marked as the ending bid of an auction, there is a 30% chance that this bid is within the last ten bids of that auction.

## ***Global Terrorism***

Sheen Dudwadkar, Michelle Lee, Carson Gullede, Grace Qiu

Over the last few decades, our news cycles seem to be saturated with terrorist attacks every few months. Terrorism and terrorist attacks are very emotionally and politically charged subjects, especially since the 9/11 terror attacks in the US. We want to create an interactive narrative visualization that more objectively presents this data. We start by guiding users through interesting/important aspects of the dataset, presenting overarching themes/questions, and then providing them with a section where they can explore the data themselves to answer questions they developed themselves. Our goal for this narrative visualization is to educate the average civilian about trends in terrorism and hopefully leave them better equipped to absorb and analyze modern terror events instead of naively believing the information presented by the mainstream media. We seek to answer whether terrorism is really more frequent and deadly today, or if the media has created a disproportionate frenzy around the subject in recent years.

### ***Incarnate: Using Programming Language Tools and Techniques for 3D Printing***

Zachary Tatlock, Chandrakana Nandi, Dan Grossman, Melissa Medsker (Galloway), Seth Pendergrass, Anat Caspi

Additive manufacturing - the process behind commercial 3D-printing - has been growing in widespread use since the introduction of the first commercially-available desktop printer. This industry has nurtured a growing community of 3D-printing hobbyists while also demonstrating potential as a solution to a variety of modern challenges, including those in biotechnology, aerospace, and industrial engineering. Despite aims to be accessible and easy-to use regardless of a user's technical background, 3D-printing technology has been known to require consumers to learn the more technical aspects of their hardware and software to "debug" commonly-erroneous prints. Our research aims at using programming language tools and techniques to provide a universal, easy-to-use tool that both analyzes and optimizes CAD and G-Code files prior to printing. By identifying and automating the common fixes users are required to manually implement in their workflow, our tools are intended to be usable for any consumer, regardless of engineering or design experience. Ultimately, our research aims at leveraging the promising market of 3D printing in reaching its potential as both a home essential and reliable solution in industrial fields.

### ***Interact***

Sheen Dudwadkar, Kristi Gable

Most people are aware of their physical health, but they often forget to evaluate their mental, emotional and social health. We all inherently realize the benefits of socializing and developing friendships, but as the pace of our modern lives continues to skyrocket, it feels as if we rarely see our friends anymore; even when we do eventually meet up, the first sentences you hear are "it's been so long" or "I can't remember the last time we hung out". With everyone so focused on their busy schedules, it's too easy to miss out on great relationships and become unintentionally distant from some of our good friends. We are designing a smartphone application that encourages people to be more aware of their social activity and helps them reach their social health goals. We do this by tracking every day social activities and providing meaningful and interactive visualizations around this data including who they spend time with, what activities they do most often etc. With this knowledge at hand, people will be able to actively shape their social life.

### ***Jasper***

Hao Lui, Tong Shen, Dylan Dabbs, Steven Austin

Jasper is a project in CSE 440 focused on the interface and user interaction design. It is an intelligent mirror specialized in wardrobe management. Users can conveniently log their outfit items, make outfit decisions based on Jasper's suggestions and track an item's location with a small tag. More at: <https://courses.cs.washington.edu/courses/cse440/17wi/projects/jasper/>

### ***Leo***

Chadi Moussi, Justin Kotalik, Austin Bisharat

Leo is a secure, end-to-end encrypted and decentralized chat application for iOS. While apps like Signal, iMessage, and WhatsApp may choose to provide end-to-end encryption, they can still collect metadata about who is talking to whom and when because all messages pass through a server. Leo solves this problem by ensuring that all messages are sent peer-to-peer and that no single entity can know who is talking to whom and when. On top of typical account security, Leo provides a new security guarantee (of protecting metadata) not seen in other commonly used messaging applications.

### ***Michael: The Bar Bot***

Mahir Kothary, Becky Leslie, Lingjiao Wang, Carl Ross, Xukai Liu

We are programming the Fetch to be a bar tending robot that can dispense beer from a tap. The Fetch robot is a mobile manipulator, which is currently an exciting area of research in robotics. Our goal is for customers in a bar to be able order a drink through a mobile application and have that order fulfilled by the Fetch. In a bar setting, the robot both provides novelty for customers and empowers human bartenders to focus on customer service.

### ***Musical Style Analysis with Machine Learning***

Felix Leeb

A new method is developed to classify music recordings by musical styles. The styles that will be considered are the Baroque, Classical, and Romantic. First, the recordings are processed into spectrograms to provide information in both the time and frequency domains. Then, a set of patches from the spectrograms are clustered with K-Means to identify general patterns therein. Finally, a deep neural network is trained on these cluster assignments to distinguish the musical styles. This two phase classification method allows K-Means to filter out the specific details between pieces so the neural network can focus on the overall structure of the music, which is more valuable for classifying the musical style. After optimizing the adjustable parameters, the overall accuracy of this method was 75%, and the remaining mistakes were most likely caused by the small dataset, rather than a flaw in the method. Overall, the method developed herein produces remarkable results, and offers a powerful new way to extract information from images so neural networks, and similar classifiers can learn more subtle patterns inside the data.

### ***Nectar: Making food service magical***

Mellissa Khuat, Amarpal Singh, Amanda Loh, Artem Minyaylov, Jesse Liston

With busy and noisy bars come neglected customers. In noisy bars, especially, servers can't hear customers calling for service. Servers also forget to deliver orders when they get busy. Due to the loud noise and forgetfulness, customers are left waiting 20-30 minutes to pay the bill, order, or receive food and drinks. Our solution, Nectar, remedies this problem. Nectar is a food serving robot in a bar environment. Our goal is to have a robot deliver trays of food to a customer based on a queuing system. The user is able, through a web interface, to place an order that is added to the robot's queue. We are implementing our idea on the Fetch robot, which has one arm with 7 degrees of freedom. Our goal is to develop a system where our robot can remember every one of our customers' orders and can deliver their orders more reliably than human servers.

### ***Sketch-A-XNORNet***

Ayush Saraf

We propose an extension to the deep convolution neural network called Sketch-A-Net, for free hand sketch classification, using weight binarization approximation techniques suggested in XNOR-Net. This would allow us to run the network on mobile devices with lower memory and compute power. In this paper we will attempt to quantitatively analyze the trade-offs between the classification accuracy and computational efficiency caused by these approximations. We will show that this will account for  $\sim 32\times$  memory savings and  $\sim 2\times$  faster convolutional operations on Sketch-A-Net. We will also show that the size of the pre-trained model (weights) is reduced by  $\sim 18\times$ .

### ***Stance Detection for Identifying Fake News***

Lilian Liang, Aishwarya Nirmal

The viral dissemination of fake news on social media can have a detrimental effect on democracy by influencing election results, as we saw during the 2016 presidential race. The first step in combatting fake news is to identify it using stance detection. Given a newspaper headline or claim, the goal of our project is to determine whether it agrees, disagrees, discusses, or is unrelated to an article. We first implemented a two-step SVM classifier. We also are implementing a bidirectional LSTM that read in headline-article pairs and was concatenated with global features. We are still in the process of completing our project, but we plan to have results by the end of this quarter when we finish the capstone.

### ***Strengthening Neural Question Answering by Learning When Not to Answer***

Kaj Bostrom

State-of-the-art neural question answering systems are currently trained with the objective of predicting the location of an answer span within a context passage. During training, these models are never shown questions without answers in the provided context. As such, they are incapable of determining whether a given question is answerable. This project will explore the ways in which training to predict when a question isn't answerable can improve the robustness and performance of neural question answering models.

### ***Wishing Well: Support your mental wellness***

Mari Chinn, Amanda Lin, Stephanie Shi, Karin Vaughan

Mental wellness is a self-defined state of wellness that differs from mental health in that mental health is often diagnosed by a professional. Checking in with yourself and meaningful social interactions are important parts of mental wellness. However, busy people find it difficult to make time for these things, particularly with the widespread use of social media. Our application tackles the issue of supporting mental wellness within a population of stressed-out college students. We encourage self-reflection with regular, customizable journaling and a color coded calendar view. We also facilitate purposeful interaction with a small group of friends through viewing their entries and a ping button to let them know you are checking on them. By supporting these tasks, we hope to facilitate widespread awareness and maintenance of mental wellness. Wishing Well does this by promoting honesty and vulnerability, regular care, and positive and healthy relationships with both yourself and your close friends.