Proceedings of the Symposium for Virginia Tech Undergraduate Research in Computer Science

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The Virginia Tech Undergraduate Research in Computer Science (VTURCS) program highlights the research and capstone projects of our undergraduate students during the past year. We are grateful for the support of Virginia Tech's Computer Science Resources Consortium (CSRC), a collection of companies that work with the Department of Computer Science to further our teaching and research mission.

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R1: **Unraveling the Mysteries of the Chromosomes**

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A cell's ability to pack an immense length of DNA into its nucleus' small volume is a relatively poorly understood phenomenon that continues to baffle scientists and researchers. The mysterious organization of this "packing" is crucial to many cellular processes as the access to and expression of certain genes are necessary for the cell's function and placement in the body. Therefore, the analysis of this singularity, being the abstruse of the folds of the chromosomes, becomes key in order for scientists to truly understand cellular processes in general. This project investigates the effects of the Topoisomerase II enzyme on the 3D architecture of the fruit fly genome. Topoisomerases are enzymes in the cell that regulate the abundant number of chromosomal coils that form in the nucleus. In this project, we investigate the changes to 3D paradigms constructed in the image of a fruit fly's genome and, depending on the level of topoisomerase, determine whether the chromosomes are bound to the nuclear surface. The project utilizes molecular dynamics simulations of coarse-grained models of chromosomes in fruit flies through the use of well-established codes in Espresso and Matrix Laboratory (MatLab). The outcome of these results indicate a faster deterioration of distinct chromosomal territories in the presence of the enzyme and propose a possible correlation between topoisomerase activity and cellular aging. Such finding suggest an immense significance of the enzyme as not only the architect of the aforementioned enigmatic designs of the chromosomes but also as a regulator for stages within the cell's lifespan.

R2: **Communication Analysis in the Social Interactome**

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The Social Interactome is a project that examines the role that social networks can play in substance addiction recovery. During the experiments, participants are able to communicate with each other in a social network, and their textual communications are stored in a MySQL database. By having access to the texts that are exchanged in the social network, I was able to learn about the various tendencies of how participants communicate in a social network for substance abuse recovery. For example, we could analyze texts to see how often success stories were shared with recovery buddies. We could also plot the direction of communications to see how much text users were sending and receiving, and therefore see if the amount of text received by a person correlates with (or is causally related to) the amount of text that person sends. My research focused on text classification and comparing communication tendencies between a lattice-structured social network and a small-world social network.

I built a multinomial, naïve-Bayes classifier to classify each text as either a success story or a non-success story. I also wrote scripts to flag texts for profanity and potentially suicidal language. By knowing which users belonged to which network, I was able to create a visualization of private messaging between the users in each network, to confirm that private messaging in the lattice network is more prevalent than in the small-world network. Moving forward, I plan to build a classifier that will classify texts containing encouragement. Also, for a future experiment, I intend to retrain my success story classifier with texts from the first experiment, in the hopes of improving the performance of the original classifier. In summary, my work involves applying natural language processing and machine learning methods to texts found in controlled social networks to help determine better ways to aid with addiction recovery.

R3: **Integrated Computational Thinking and Chemistry (Chem + C)**

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Computational thinking (CT) has received an increasing amount of attention over the past decade. Computers have an undeniable presence in everyone's life as they have become a vital tool in many various fields. This, along with supporting research, has led many to reach an agreement on the importance of teaching CT in the K-12 educational system. Unfortunately, the agreement of its importance has translated very poorly as there are a limiting amount of programs to teach CT in school. This void led Dr. Deborah Tatar to create this project. This project is a multi-agent based simulation application that uses Netlogo to create activities of four chemistry environments which include simulations and models. The purpose of this project is to give aid in teaching key ideas of chemistry, computational thinking, and evidence-based argumentation to 8th graders. The goal is to let 8th grade chemistry students learn how earth-science systems work by interacting with graphically-based computational models and simulations. They will also be able to modify the code in these models in order change the nature of the simulation and to fit their needs. This will allow the students to build computational thinking skills while learning chemical systems. To achieve these goals, models using Netlogo were developed and built into the web-based application environment using Scala and Javascript (Node.js). This allows the student to examine the simulation, change the code and recompile it to learn chemistry, along with the logics and principles of computational thinking. The combination of chemical simulations and computer programming makes it so that students will be able to learn more about the various earth-science systems (cycles), while learning more about coding. Through this process, students will develop a strong foundation in computational thinking. Future goals of this project include expanding the application to cover more science topics and inspire students to get involved in STEM fields.

R4: Computational Analysis of Music Scores: Techniques and Applications

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In Western classical music, composers encode their performance directives for performers by means of a score. Using special notation, a music score expresses a sequence of physical motions that performers need to make to perform it. Music scores are analogous to computer programs, which encode a set of instructions for a computer to execute. Program analysis is an important CS research area concerned with creating techniques to infer useful information about programs. Applications of program analysis range from bug finding to performance optimization. Drawing on the analogy between computer programs and music scores, this project seeks to develop computational analysis techniques for scores. Although music scores have always been analyzed by hand, computational techniques can not only improve precision and scalability, but also make it possible to answer new kinds of fascinating questions about music scores. In particular, we have applied our newly developed computational analysis techniques for music scores to two different problems: (1) Estimating the complexity of a music score for a given level of playing proficiently, and (2) Inferring meaningful composer-intended intensity levels for each constituent element of a score to capture the essence of musical expression. Estimating the complexity of a music score has useful applications in music pedagogy, suggesting pieces whose complexity levels appear in a gradual increasing progression. Inferring the intensity level for the constituent element of a score aims at capturing the emotional meaning of music. We intend to use the inferred information to enrich electronic music synthesis, making it emotionally meaningful for the listener. The inferred inflection pattern of a piece can also benefit music practitioners and educators. By also applying music theory, we can systematically uncover what makes music emotionally stimulating. Finally, by creating a reusable library of the computational analysis techniques for music scores, we also lay the foundation for other researchers and practitioners to both extend our library with new techniques and to find new innovative applications for them..

R5: GALVIS: Galaxy Assembly & Large-Scale Structure Within Virtual Realities

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Within the next several years, astronomical survey datasets will explode to fantastic sizes, on the order of 100 million galaxies and petabytes of data. As a result, the field of observational astronomy finds itself in need of developing methods to both efficiently access these datasets, as well tools that allow astronomers to interact with it meaningfully. These complications require careful analysis and consideration as astronomy progresses. To address these looming problems, this research project aims to investigate the question of how to most effectively use three-dimensional data visualization in an astronomy research setting. Ultimately, our goal is to create a visualization plugin for the ParaView platform, GALVIS, which will be able to scale to handle large-scale galaxy surveys on the order of 1 million to 100 million galaxies. We will investigate the problem of making the system intuitive and effective to use even though the nature of the Universe's geometry differs from our intuitive notion of space, and the underlying equations that yield important measures are highly abstract.

R6: Computing Partially-Disjoint Shortest Looped Paths in Directed Graphs 600x Faster

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Signaling pathways capture how cells respond to signals they receive from other cells and their environment. Such a pathway can be represented as a directed graph that starts at “sources” (proteins on the cell membrane that sense signals) and culminates at “targets” (proteins that effect the cell’s final response to the signals). Several methods exist for automatically reconstructing signaling pathways from large-scale protein interaction networks. A drawback common to all of them is that they guarantee only one path between a source and a target, which cannot recapture the redundancy that cells have evolved in signaling pathways. Our group recently developed the PathLinker algorithm that computes multiple loopless short paths between sources and targets in a directed graph. While multiple paths address the issue of redundancy, PathLinker suffers from two new problems: (a) it cannot capture feedback loops in signaling networks and (b) paths are often very redundant, e.g., 20,000 paths that PathLinker computed in a human interaction network contained only 5000 unique edges. In this project, we develop a new algorithm to remove both these deficiencies. It computes the k shortest looped paths from sources to targets with the property that each path contains at least one edge not contained in any earlier path. While Pathlinker’s output can be modified to satisfy this property, in the worst case it may compute an exponential number of paths before it encounters a new edge. Our new approach is remarkably simple: Instead of creating increasingly longer paths until a path contains a new edge, we compute the shortest path that uses each edge. We show how to combine the results of Dijkstra’s algorithm on the original graph and its reverse to compute all such paths in $O((m+n) \log n)$ time, where n is the number of nodes and m is the number of edges in the graph. When applied to the signaling pathway problem, our algorithm is faster than PathLinker by a factor of 600: it computes 30 times the number of partially-disjoint looped paths that Pathlinker generates, and does so in 1/20th of the time.

R7: Willgrind: Dynamic Program Analysis for a Fork-Join Framework

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The fork-join threadpool is one of the more challenging projects in the computer science curriculum here at Tech. Students in CS 3214 must manage a group of threads to facilitate the shared execution of dynamically created tasks. The difficulty lies in the challenges of concurrent programming and the specific semantic requirements of the project. When working on the threadpool project many students received inconsistent test results and were left confused when debugging. Additionally, some projects passed the grading requirements even though they did not conform to the specifications. Existing general purpose thread debugger, Helgrind, is useful for detecting data races but unable to check semantic requirements of the project. Thus, there is a need for a tool specifically tailored for this project. Our research has developed Willgrind, a dynamic analysis tool customized for the fork-join threadpool project. Willgrind models the correct behavior of each submitted task by defining multiple invariants and verifies that the actual execution follows this model. For instance, the tool checks that submitted tasks are completed before the client obtains the result. Other invariants include the absence of deadlock and presence of concurrency. If a violation of an invariant is found, the user is given a message along with a stack trace, helping them find the cause of the bug. We used the Valgrind framework to instrument students' threadpool executables with additional code to monitor the invariants. Our implementation operates on Valgrind's intermediate representation (IR). We used our tool to analyze two semesters of student submissions and we provided the tool to students prior to the deadline for the current semester. The tool was able to identify invariant violations in multiple student submissions. Thus, special purpose dynamic analysis tools such as Willgrind could be beneficial for computer science classes such as CS 3214.

R8: Mapping The Fourth of July in the Civil War Era: a Crowdsourced Digital Archive

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Mapping the Fourth is a crowdsourcing experiment built on top of Incite, a crowdsourcing platform developed in the Crowd Lab at Virginia Tech. This platform allows users to transcribe, such as converting images and transcribing text from documents like letters. Tag, such as finding various entities inside of transcribed documents. Connect, such as adding high level topics such as ideals and revolutionary history to the document and Discuss, which includes having social interaction and discussions between users over various documents. This application has gone through various iterations of design and development and was part of a large scale study in collaboration with the National Archives and Virginia Center for Civil War Studies.

R9: **MindMapper: building a focus monitoring tool**

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With the Use of EEG devices, we can describe and measure personal engagement levels and then relay this data in informative fashion to users. This data will be visible to users in an Android application that will help users better help and monitor their "Quantitative Self". This research is part of the recent "Quantitative Self" movement. This movement is essentially trying to give an everyday person the ability to log, analyze, and productively respond to information about their body. Some popular devices in this market sector include the Fitbit and the Jawbone Up. These devices are unobtrusive pedometers with simple and usable user interfaces that allow users to statistically observe and analyze data. But, currently, most devices in this space only focus on the physical aspects of a User's "Quantitative Self". As it stands, there are no devices that focus on the mental aspect or on objective mental metrics. There are no ways to objectively track mental performance as it stands right now. The authors have found that Engagement is a usable and actionable mental metric. Just like movement, it is difficult to remember how objectively engaged one is at a given time. For example, one might know that he or she has walked quite a bit, but he might not know the exact objective distance. Just like that, one is more than likely to know an average engagement rather than an exact objective amount, which is why it would come in handy to have a mental tracker. In order to accomplish this task, we decided to make an android application that would help users use EEG devices like the Neurosky Mindwave as a mental tracker. This application combines objective and subjective data and allows the user to combine different contexts to better understand their day. Using the EEG, they can annotate and create a focus score as well as view different graphs of their activities. This allows users to better reflect on their data and better understand how to make changes to their daily routines..

R10: **The effects of Isomorphic avatar based neuro rehabilitation**

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The purpose of this project is to develop a therapy application with the Microsoft Kinect camera. We created the two types of avatar. The first avatar is a common avatar with no individualized appearance. The second type of avatar is customized in shape and appearance to resemble each user. We used the structure.io scanning camera to capture the user as 3d model. This camera create meshes that have 50,000 ~ 60,000 vertices, and a texture of the object. We rigged the mesh in 3D Studio Max and programmed the avatars using the XNA Framework to manage the runtime environment and user interactions. We developed three exercises: set the bar, bend a joint, and catch the ball. Users receive visual and auditory feedback on their successful completion of each exercise. We are piloting this application with patients at Lewis Gale.

There are two main points for this project. First point is that we created two different avatar. The reason why we created two types of avatar is to observe the reaction of user from two different avatar. One is typical type of human character that moves just like user. Another avatar is customized avatar that makes user feels like user seeing themselves. Second point is we modified the program to move the avatar more than real movement. We are currently developing the program that user can customize themselves. Since every user want different type of exercise.

R11: Investigating Collaboration on Large Multi-Touch Displays

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The goal of this project was to develop an application that would encourage collaboration amongst multiple users while also having the ability to analyze their interaction. This is done with the Microsoft Perceptive Pixel, a large multi-touch display that can handle up to 100 individual touch points. We have been focusing on expanding our knowledge and understanding of how people collaborate and interact when working towards accomplishing a task while using the same device. The base of our research is a card based system that is inspired by traditional paper/card categorization. The idea is that there are cards that represent some sort of data, and these can be put into categories by dragging and dropping the card over a category that the user feels that the card belongs in. Using this implementation, we wanted to focus heavily on three aspects. First, we wanted to test user awareness when using the device and application. Awareness is divided into three categories: social (who is around), action (what is happening) and activity (how things are going). So we would like to study how awareness is influenced by sequential vs. simultaneous tasks. Our next area of emphasis is categorization. Categorization is a tool that users can use to recognize, identify, and differentiate pieces of information in a useful way. Our implementation includes a feature that allows users to place their cards into categories as they see fit, and the other users will be notified of these actions. Lastly, we wanted to incorporate semantic zooming into our application. Semantic zoom allows different thresholds for cards and what they display. As a card is enlarged by a user, more information will be shown on the card and less if the card is made smaller. For example, a card may show the title of an article, but when enlarged the card will show a summary of the article and when enlarged further the user will be able to view the full article. This feature creates a bit of individuality for the user while also increasing user interaction with the multi-touch display. Awareness is divided into three categories: social (who is around), action (what is happening) and activity (how things are going). So we would like to study how awareness is influenced by sequential vs. simultaneous tasks. The Microsoft Perceptive Pixel is a new technology that is designed to potentially revolutionize collaborative interaction in places such as the classroom or a conference room. The base of our research is a card based system that is inspired by traditional paper/card categorization. The idea is that there are cards that represent some sort of data, and these can be put into categories by dragging and dropping the card over a category where the user feels that the card belongs.

R12: Investigating Users' Collaborative Awareness on a Multi-User Multi-Touch Display

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The goal of this research is to focus on developing a better understanding of how collaborative abilities in group work has on the usability of engineering processes. Understanding how people interact with each other in a digital space will foster ways to improve technologies of collaborative awareness. In this study, the Perceptive Pixel, a 55-inch multi-touch display, is utilized to observe users' awareness when collaborating in small groups. From the observation of activities such as sorting digital cards, the anticipated findings feature the discovery of new collaborative awareness.

Our user study consists of 60 participants between the ages of 18-25 years old whom of which work with a confederate. The task is to sort 36 travel cards into 3 categories: Definitely Visit, Probably Visit and Possibly Visit. The information on the cards includes the places, days of stay, and the expected costs. The confederate has the same passive behavior and sorts the same 12 cards in 7 minutes. Group A works with a notification and Group B works without a notification. To draw conclusions about awareness, there is a questionnaire that asks about 6 of the confederate cards. This research evaluates how awareness is affected by the reaction time and the touch count. It is found that users who use the system with a notification react faster and visiting the cards more times enhances awareness. Group A, the group with the notification, users tend to touch their cards less and place their cards in the center without processing the information. Group B, the group without the notification, users touch their cards more and place their cards on the side. Lastly, the 4 organizational patterns that users tend to follow include: Categorized and Spread, Categorized and Clustered, Non-categorized and Spread, and Non-Categories and Clustered. We seek to expand the knowledge of collaborative awareness.

C1: Neuroevolution of Augmenting Topologies: Machine Learning in Finite Solution Spaces

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Machine learning is becoming prevalent in the computing fields to learn from and make predictions on data. The purpose of our project is to explore modern machine learning algorithms, strategies, and theories to understand their applications in solving problems within finite solution spaces. Machine learning can be used in a variety of applications, specifically those with defined solution spaces. For example protein fitting, and other problems that have specific solutions within a vast amount of possible solutions. To do this, we first implemented the game Connect Four. Connect Four has reasonable complexity, persistent board states, and non-trivial solution space. The solution space of this game consists of approximately 1.6*1013 possible board states (excluding illegal board states). The solution space can also be expanded via rule adjustments, for example adding several boards in layers to create 3-D Connect Four. Neuroevolution of Augmenting Topologies (NEAT) was the best fit for analyzing these states because it requires minimal historical data overhead. However, processing and mutating genomes in the network requires a significant amount of computing resources thus requiring machine learning restructuring to support parallelism for increased performance. Our implementation of NEAT was able to outperform a minimax AI for Connect Four after 640,000 games played between the neural network and each minimax, random, and stack up player. The most fit genome to move on to the next generation wins most of the games. NEAT utilizes such three types of AI to train and evolutionize to different playing strategies. As a result, NEAT has constructed a massive, complex neural network as a result of multiple generations in a small time frame aided by multithreading on Virginia Tech's rlogin cluster sporting 64-cores. In the future, we will deploy our program to the web application (Java Servlet) with additional features, including: distributed computing such as Hadoop, customization of the game rules, and expanding the board size.

C2: **Multimedia Database**

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The purpose of this project is to create a centralized system where Computer Science students at Virginia Tech can upload their personal projects for professors to view. The client wants our team to create a MySQL database for multimedia content and a website prototype to interact with the database. Our team will implement a backend database and a frontend website. The ultimate goal is to implement a website which makes searching for research opportunities easier for students and professors.

C3: **Securing Spark**

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In the era of big data, the efficient analysis of massive datasets is rapidly becoming the norm in several practices. Apache Spark is a general computation engine designed to work datasets like these on top of a distributed file system. Spark does not yet support encryption natively, and this is a huge problem for many. Especially for businesses or governments that are required to meet a certain standard of encryption for their data, this simply will not suffice. The aim of our project is to design a solution to a specific threat model in Apache Spark: preventing people within an organization with authorized access to a machine from having easy access to each other's files. To adequately address this scenario, data should only ever be unencrypted in memory, with the goal being to minimize the amount of data exposed at any given time. We present a method of encryption to solve part of this problem in the form of an Apache Spark RDD transformation.

C4: CINEMAcraft: Virtual Minecraft Presence Using OPERAcraft

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CINEMAcraft is an interactive system built off of a Minecraft modification developed at Virginia Tech, OPERAcraft. The adapted system allows users to view their mirror image, as captured by Kinect sensors, in the form of a Minecraft avatar. OPERAcraft, the foundation of the project, was designed to engage K-12 students by allowing users to create and perform virtual operas in Minecraft. With the advanced functionality of CINEMAcraft, the reinvented system aims to alter the perspective of how real-time productions will be produced, filmed, and viewed. The system uses Kinect motion-sensing devices that track user movement and extract the associated data. The data is processed and then sent through a middleware, Pd-L2Ork, to OPERAcraft, where it is translated into avatar movement to be displayed on the screen, resulting in a realistic reflection of the user in the form of an avatar in the Minecraft world. Within the display limitations presented by Minecraft, the avatar can replicate the user's skeletal and facial movements, movements involving minor extremities like hands or feet cannot be recreated because Minecraft avatars do not have elbows, knees, ankles, or wrists. For the skeletal movements, three dimensional points are retrieved from the Kinect device that relate to specific joints of the user and are converted into three dimensional vectors. Using geometry, the angles of movement around each axis (X, Y, and Z) for each body region (arms, legs, etc.) are determined. The facial expressions are computed by mapping eyebrow and mouth movements within certain thresholds to specific facial expressions (mouth smiling, mouth frowning, eyebrows furrowed, etc.).

C5: **Microaggressions @ VT**

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According to Dr. Stephanie Adams, Department Head of Engineering Education at Virginia Tech, "The value of having diversity is that it brings multiple perspectives to solving problems. If everyone on the team looks the same, and has had the same experiences, then they can't think about it from another person's perspective. But when you bring people together with diverse backgrounds, races, genders, and sexual orientations, the group can approach a problem from a range of perspectives that makes for a much better solution." A more diverse community at Virginia Tech brings multiple perspectives to solving problems. Creating a cultural climate that is supportive of everyone can be difficult because of microaggressions. Microaggressions are the seemingly harmless snubs or insults communicated verbally or nonverbally that target an individual based on group membership. Eliminating the occurrence of microaggressions maintains and promotes diversity at Virginia Tech. The College of Engineering is particularly homogeneous and is thus an excellent starting point for addressing microaggressions. The College consists of 85% male professors, and 15% female professors, of which 0.3% are American Indian, 21% Asian, 2% Black, 65% White, 6% Hispanic, 0.3% Multiracial, and 7% non-resident alien. To bring about a widespread understanding of how microaggressions affect people, a website (www.microaggressions.cs.vt.edu) allows faculty members in the College of Engineering to anonymously share personal experience with microaggressions. By submitting anonymous posts, faculty can freely express concerns, which can then be viewed publicly. This helps bring to the surface hurtful comments that repeatedly get dismissed in the work environment. It is important to be able to study these posts – uncovering hidden patterns and other insights – to better understand the problem. We have incorporated filtering and visualization tools like a word cloud, N-grams, and graphs to allow the user to better understand patterns underlying the problem. We also implemented a simple anonymity checker that analyzes the post upon submission, looking for keywords that could identify a person. This, combined with a panel that allows the administrator and moderators to manually approve and flag posts prior to publication, ensures anonymity and privacy. Making faculty feel more included at Virginia Tech is the goal of this website. Our goal is for ALL faculty to feel accepted and included at Virginia Tech. We will accomplish this by raising awareness of the damaging impact of microaggressions.

C6: **WatchDog: Assisting People with PTSD**

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PTSD, or posttraumatic stress disorder, is classically defined as a mental disorder that develops after a person experiences a traumatic event(s). PTSD affects every individual differently, but common symptoms include altered thought patterns, flashbacks of the event, inability to sleep, depression and paranoia. Because PTSD is so personalized for each individual it can prove very difficult to treat effectively. Some common treatments throughout the years have involved medications such as benzodiazepines and a variety of different therapy techniques including such techniques as exposure training and eye movement desensitization and reprocessing (EMDR). Many of these classical techniques are avoided by individuals suffering from PTSD due to the current stigma surrounding mental disorders or their inability to afford or attend the necessary facilities to undergo treatment. Introducing WatchDog, our team's attempt at providing a personal PTSD coping tool using cutting edge wearable technology. We have been working closely with a local psychologist by the name of Dr. Alexa Casey to develop an unobtrusive methodology that alerts PTSD suffers when they may be experiencing an anxiety attack or flashback. We accomplish this by monitoring a user's heart rate through sensors in Android Wear devices and comparing it to the user's calculated baseline. Once we are aware of this change in one's heart rate we are able to interject alerts and encourage a user to engage in calming activities (either through the technology or outside of it). We feel that our solution works well for people who want personalized and private coping methods at a cost that will only continue to go down as wearable technology becomes more and more common.

C7: Dyslexia App: Training Tool to Help Improve Reading and Comprehension Skills

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The goal of this project was to develop an application to help improve the reading skills of people with dyslexia by testing them with error-prone passages and giving them feedback. Most existing applications are targeted at younger readers and many are prohibitively expensive. We crafted an achievement-based application where good performance allowed the user to advance to harder levels. Difficulty levels were tied to a scientifically-validated confusion set that contained different words that people with dyslexia often misspell. As the user advances to higher levels the words will be drawn from progressively more difficult levels in the confusion set and the sentences themselves will get longer and more complex. A key component of our system is implementing a version of NLP, Natural Language Processing, which is machine learning code that learns which words the user is struggling with or needs improvement on. In our app we have an algorithm that adjusts a counter based on the number of times the user gets an exercise right or wrong for each level, as well as each word. Once the algorithm's requirements are met by the user the next level is unlocked. Another part of NLP in our system is not just adjusting the level of difficulty of the words by level but also the overall difficulty of their sentences. We use a database to track the user's progress which is reported back to the user in the results page for personal reflection.

C8: **FitEx: Smartwatch Interfaces for Team Fitness and Tracking**

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The problem presented to us was to develop a solution that presents FitEx functionality, messaging, tracking team and personal rankings, and adding activities and fruit to track. Additionally, we needed to present it in a way that kept the user engaged with the FitEx program, i.e. communicating with members and starting activities. We also wanted to reduce overhead tasks like unlocking phone, opening app, and other tasks that contribute to using the app but are not part of using it, with interacting with the FitEx application. The solution we chose was to implement FitEx app on wearable technology. The device family we developed for was Android Wear. The features that can be implemented on this platform are the team and personal ranking tracking and the activity and fruit selections. The messaging functionality can show what messages you have and details about them, however, responding to them would be left to the phone or website. The testing we did includes a feature survey, the phone app usage test,and a heuristic evaluation. From the phone app testing we found that the responsiveness of the phone app was noticeably slow and that the layout was not user friendly.

C9: What Should I Eat? Mobile Recommender for Hokie Dining

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Counting calories is essential to meeting your fitness goals. In fact, many dietitians and fitness experts ask their clients to count their calories and other macro-nutrients daily to help meet their goals. Whether you are trying to gain or lose weight, counting calories is important and can help you reach your goals faster. Every little bit counts. However calorie counting is incredibly cumbersome. Most people try to eat out and rely on food labels or use kitchen scales and measure ingredients to the ounce. In addition, it is hard to meet the remaining portion of your calories at the end of the day. What Should I Eat? helps to solve that problem. What Should I Eat? ranks the food items based on distance from caloric goal and food preferences to give you better suggestions for dishes to eat. Have 500 calories left for dinner? Use What Should I Eat? to get a dish to meet your goals. The goal of this app is to help give better recommendations to users. We believe that this will in will help users better meet their goals and over time will help lead healthier lives.

C10: **Applying HCI Techniques to Help the Visually Challenged**

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Virginia Tech's Cogent Lab researches, among other things, Augmented Reality as it applies to driving. One of the chief tools of this research is the National Advanced Driving Simulator "MiniSim", but this tool has been limited to non-dynamic augmented reality "work-arounds". With the development of our extensible overlay, our team has provided this capability and a solid foundation for future work. This was done while applying HCI techniques to a "Universal Design" (designing so that the system is inherently accessible to people without impairments while providing for those with impairments) so that the system is unique in its own right, rather than a simple addition to MiniSim. Initial evaluations of progress towards that goal were promising, with 63% of users able to easily respond to the overlay, even with simulated tunnel-vision.

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C11: **Autism Speech App: Connecting Parents and Therapists through Mobile Technology**

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Autism spectrum disorder (ASD) or autism are general terms to define a set of complex disorders of brain development. The disorders are distinguished on several different degrees with regards to difficulties in social interaction, verbal and nonverbal communication and repetitive behaviors. Therapists use Pivotal Response Treatment (PRT) as it is one of the best studied and validate behavioral treatments for autism. PRT therapists focus on “pivotal” areas of child’s development rather than individual behaviors.

Hence, the parents are advised to record the PRT tasks weekly given by the therapists. We created a parent interface in which the parent can record 10min weekly sessions to send to their therapists. We also created a therapist interface in which they can receive the videos from parents and can impose fidelity coding. Fidelity coding is simply a sheet with several different categories that the therapist rates on the child’s behavior. Our main for this project was to ease the communication between parents who have autistic children and their therapists.