ANDREWS UNIVERSITY
HONORS SCHOLARS
HONORS THESIS POSTER SYMPOSIUM

Logistic Map

X_e

$X_{n+1} = r\,X_n\,(1 - X_n)$
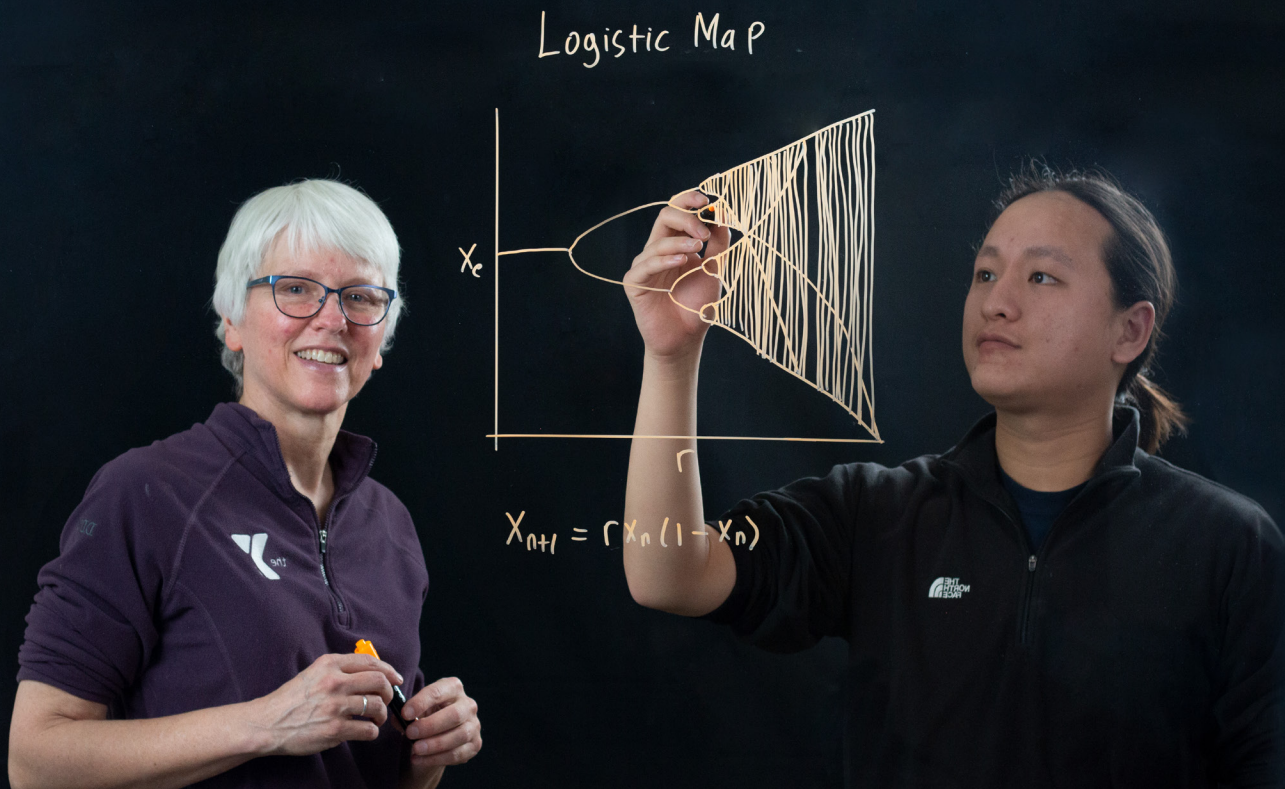
5 March 2021

1:30 - 3:00 P.M.

BULLER HALL
CLASSROOMS

J.N. Andrews
Honors Program

WELCOME

Thank you for joining us for the 2021 Honors Thesis Poster Symposium. We feel grateful and blessed to be able to gather in person to celebrate the creativity and curiosity of this year's Honors Thesis researchers. As with so many other activities, the COVID-19 pandemic has challenged the usual practices and routines associated with quality undergraduate research. I want to thank heartily all the Honors Scholars and their dedicated faculty research mentors for finding the extra resourcefulness and commitment needed to continue the thesis journey. The Honors Family and I rejoice in your perseverance and discoveries, claiming the reassurance found in 1 Corinthians 4:8-10: "We are troubled on every side, yet not distressed; we are perplexed, but not in despair; persecuted, but not forsaken; cast down, but not destroyed; Always bearing about in the body the dying of the Lord Jesus, that the life also of Jesus might be made manifest in our body."

Since its founding in the 1960s, the J. N. Andrews Honors Program at Andrews University has fostered enthusiastically the transformative experiences of undergraduate research. By means of the Honors Thesis, the Honors Program requires its students to engage in substantive primary investigations in which students take an active role in posing research questions, designing and refining methodologies, collecting data and results, and critically analyzing the significance of their conclusions.

The Office of Research and Creative Scholarship, led by Dr. Gary Burdick, serves a vital role across campus in supporting and funding quality undergraduate research. The Undergraduate Research Scholar Award was established in 2002 to facilitate more opportunities for students to engage in research and creative scholarship in greater depth than required by their individual programs of study. The URS Award enables students to work closely with faculty mentors, participate in disciplinary conferences, and develop important professional skills. Many Honors Scholars have benefited from the URS funding and have noted that support on their poster boards.

A team of highly engaged faculty research mentors makes possible a rigorous program of undergraduate research. We thank each mentor for the commitment of time and energy invested in Andrews University's young scholars. The J. N. Andrews Honors Program and Office of Research and Creative Scholarship thank the Andrews University faculty members and Honors Council members who give willingly of their time and energy to support and evaluate undergraduate research. The Honors Council Members include: Sonia Badenas, Karl Bailey, Vanessa Corredera, Ryan Hayes, James Hayward, Alyssa Henriquez, Shandelle Henson, Katherine Koudele, Beverly Matiko, Andras Muranyi, Benjamin Navia, L. Monique Pittman, Davide Sciarabba, Tiffany Summerscales, Karin Thompson, and Robert Zdor. We also thank our Honors Program administrative assistant and recruiter, Maxine Umana, and the ORCS staff, Carlisle Sutton and Mordekai Ongo, as well as our student assistants, Isabelle Dias and Elianna Srikureja, for their hard work in helping to make this event a success.

L. Monique Pittman, PhD
Director of Honors
Professor of English

Honors Thesis Poster Presentations

Buller Hall 108

P-01   Jeremy Ahn (Max Keller, Music)
Producing Music Using Negative Harmony

This project uses Negative Harmony as a basis and reference point for producing original songs in the style of instrumental jazz and funk. Negative harmony is a loose term that describes a technique of reharmonization made popular by musician Jacob Collier. While negative harmony is best understood as a reharmonization technique, I am essentially writing new songs with chord progressions that strive to replace common chord progressions with their negative harmony counterparts. I ultimately seek to make music with unconventional but viable harmonies and grow as a musician in the process.

P-02   Janelle An (Benjamin Navia, Biology)
Evaluation of Phonotactic Behavior in Male-exposed Female Acheta domesticus
Undergraduate Research Scholar

Phonotaxis can be defined as the movement of organisms in response to an auditory stimulus. It plays an important role in helping an animal find a potential mate. Thus, it is worthwhile to understand what factors may influence it. This study investigates possible changes in phonotaxis of young females when raised with males but not allowed to mate. Preliminary results show a significant difference in the behavioral response of young male-exposed females when compared to those of virgin females. These results suggest that factors other than mating may alter the female's response and its underlying neural elements that control behavior.

P-03   Annelise Burghardt (Charles Reid, Music)
The History and Current Discourse on Orientalism in Opera

The world of opera is beautiful, but often marred by the historical ideas and accepted practices of the times in which works were created. This project is a consideration of the history of Orientalism in opera and the current discourse on Orientalism and cultural appropriation. I will be focusing on the historical context of cultural appropriation and current trends for responding to the same in the performing arts, with attention to the dynamics of gender and place in several of the selected operatic works, consideration of the problem of whiteness in opera, and the resulting issues of cultural appropriation and impersonation.

P-04   Ruth Burn (Rahel Wells, Religion; Scottie Baker, University Press; Beverly Matiko, English)
An Egyptology-Informed Exegetical Analysis of Psalm 90 with Creative Applications

While scholars continue to debate Egyptological influence in the Torah, few recognize or acknowledge it in the Psalms, though the superscription of Psalm 90 does indicate Mosaic authorship. This project first examines the structure and significance of the Egyptian nuances within Psalm 90, and proposes an approximate time of composition relative to Moses's life. Following a study of the historical context, I craft a well-researched fictional narrative that aims to immerse young-adult readers in the world of the psalm. This project draws connections between Moses's struggles and those of a modern audience, foregrounding insights discovered during an extensive process of exegetical and historical research.

P-05 Amanda Cho (Tom Goodwin, Biology)
Comparison of Enamel Microstructure of Ictidomys Tridecemlineatus Formed During Hibernation Versus the Active Season

Ground squirrel incisors grow continually, preserving a record of their most recent weeks of life. Previous research demonstrated that an abnormality in the surface of incisor enamel and dentin of thirteen-lined ground squirrels (*Ictidomys tridecemlineatus*) corresponded with hibernation. Using scanning electron microscopy, we compared internal microstructure of incisor enamel deposited during and outside of hibernation to determine if external disruptions corresponded to differences in internal microstructure. However, after documenting microstructure for several incisors, we did not observe microstructural differences. Thus, the surface abnormalities of incisor enamel that form during hibernation are not associated with abnormalities in internal enamel microstructure.

P-06 Isabelle Dias (Heather Ferguson, School to the Communication Sciences & Disorders)
Parental Stress and Feelings of Support by Speech-Language Pathologist of Children Receiving Speech and Language Services: A Correlational Study During COVID-19

Due to COVID-19 parents have been thrown into the role of teacher, tutor, playmate, and parent. For parents of children with communication disabilities, they may also feel like they have to become a speech-language pathologist. We are in a period when parents have a higher desire to receive help, but there is less help being given by social service providers. This study seeks to investigate the stress levels of parents with children who have been diagnosed with a communication disorder and if these parents feel supported by their child(ren)'s speech-language pathologist during COVID-19. This will be determined using a simple survey containing 56 questions, 18 of which are from the Parental Stress Scale. The purpose of this study is for speech-language pathologists to better understand parental needs and continue to devise plans to better assist parents during these difficult times.

P-07 Sofia Hanapin (Getahun Merga, Chemistry & Biochemistry)
Silver Nanoparticle Synthesis by Microwave and Non-microwave Methods Using Hydrogen Gas as a Reducing Agent

Synthesis and characterization of silver nanoparticles are of current interest. This research project describes a simple and rapid synthesis of silver nanoparticles upon reduction of Silver(I) oxide (Ag_2O) by molecular hydrogen. The production of nanoparticles can be achieved by purging a solution of Ag_2O and water with hydrogen gas and heating for a maximum of two minutes using a common kitchen microwave. This reaction generates nearly naked silver colloid that contains no foreign stabilizers other than metal particles and water species. Its application is then evaluated with biological cultures to test for the antibacterial effects of the made particles.

P-08 Kara Herrera (Beverly Matiko, English)
One Writer, Two Genres: Composing and Analyzing Creative Non-fiction and Fantasy

Creative writers face a wide range of options when they sit down to craft art out of words. Available to them are many genres, each with their own characteristics or traits. Additionally, many writers have accomplished self-reflection in interviews, Q&A sessions, and in print. It is not unusual to find writers taking their craft and turning it into their subject matter. This project aims for the same. In order to analyze the similarities and differences in the writing process across genres, a "writing about writing" essay is included along with four creative non-fiction essays and a young adult fantasy novel draft.

P-09 TJ Hunter (Rodney Summerscales, Computing)
An Artificial Intelligence Approach to Mancala

Through the study of popular games such as Chess and Go, countless artificial intelligence (AI) research has been conducted in an attempt to create algorithms equipped for adversarial search problems. However, there are still a plethora of avenues that offer insight into further development. Mancala is traditionally a two-player board game that originated in the East and offers a unique opponent-based playing experience. This thesis not only attempts to create a competitive AI algorithm for mancala games by analyzing the performance of several different algorithms on a number of mancala variations, but it also attempts to extract applications that may have relevance to other "game-solving" AI problems.

P-10 Aaron Jacobs (Lisa Ahlberg, Chemistry & Biochemistry)
Finding optimal OPA-IBLC Derivatized Amino Acid Analysis Parameters with 3-dimensional Fluorometric Scans for HPLC Method Validation
Undergraduate Research Scholar

This research validates RP-HPLC fluorimeter and OPA-IBLC derivatization parameters to lower limits of detection (LOD) and quantitation (LOQ). A 3-dimensional fluorometric scan in pH 10.4 sodium borate buffer showed peak OPA-IBLC derivatized histidine and glutamic acid fluorescence occurs at 368- to 445-nm and 336- to 452-nm $\lambda\neg$ex-$\lambda\neg$em, respectively. HPLC-FLD response was refined with systematic FLD analysis in pH 4 sodium acetate buffer after column separation. Derivatization reaction completion was ensured by increasing injector mixing time until peak integration area stabilized. Results inform future FLD parameters and determine racemic OPA-IBLC derivatized amino acid ratios in ostrich eggshells.

P-11 Ryutaro Jacobson (Ryan Hayes, Chemistry & Biochemistry)
PAMAM Dendrimer Synthesis Optimization Through Reaction Kinetics

The goal of this project is to optimize PAMAM dendrimer synthesis reactions by studying their kinetics. PAMAM dendrimers are produced by reacting methyl acrylate with ethylene diamine, so determining the best reaction conditions for these compounds will help improve dendrimer production. Controls for reactant feed rate and reactor cooling are to be used so that the determined ideal conditions can be maintained. This has the benefit of requiring less processing time as well as improving the ease with which the reaction can be monitored by a researcher.

P-12 Lisa Johnston (Lynelle Weldon, Mathematics)
Identifying Persistent Misconceptions on Linear Equations

Every student at Andrews University who does not have a satisfactory math placement must review prior math concepts before taking general education math courses. Our research seeks to answer which misconceptions are persistent on linear equation questions. Our findings report that many errors in student work can be remedied by more focus on basic linear concepts, such as what slope means, and how points are plotted. We hope our results will guide us as we make substantive and positive changes to the remedial math curriculum with the goal of maximizing student comprehension while still maintaining a level of individualized learning.

P-13   Hailey Kim (Desmond Murray, Chemistry & Biochemistry and Marlene Murray, Biology)
The Effect of a Novel Hybrid Drug on the Inositol Signaling System in the Yeast Saccharomyces Cerevisiae
Undergraduate Research Scholar

Bipolar Disorder is one of the major mental illnesses in the world. While there is insufficient understanding of the mechanism of the disease, many of the drugs used for treatment appear to work via the inositol signaling system. The purpose of this study is to develop a novel hybrid drug containing valproate and caffeine and determine its impact on the inositol cell signaling system. To do so, the yeast Saccharomyces cerevisiae was grown in varying concentrations of the hybrid drug, and inositol concentration will be measured in cell extracts.

P-14   Solomon Kim (Rodney Summerscales, Computing)
Variational AutoEncoders for Biosensor Data Augmentation

Over the past decade machine learning and artificial intelligence's resurgence spawned the desire to mimic human creative ability. Initially attempts to create images, music, and text flooded the community, though little has been learned regarding constrained, one-dimensional data generation. This paper demonstrates a variational autoencoder approach to this problem. By modeling biosensor current and concentration data we aim to augment the existing dataset. In training a multi-layer neural network based encoder and decoder we were able to generate realistic, original samples. These results demonstrate the ability to realistically augment datasets, improving training of machine learning models designed to predict concentration from input signals.

P-15   Nathaly Manrique (Brian Wong, Biology)
Modulation of Apoptosis in Breast Cancer Cells MDA-MB-157, 93A and 93B by Aqueous Extract of Chinese Medical Herb Scutellaria Barbata
Undergraduate Research Scholar

Scutellaria barbata (SB), a Chinese Medical herb, has been known to contain anti-cancer properties. In this study, the effectiveness of SB in apoptotic modulation of APC-mutant breast cancer cell lines MDA-MB-157, 93A, and 93B was investigated. Assessments were performed using green/red/blue fluorescent Apoptosis/Necrosis Detection Kit and the Human Apoptosis Antibody Array - Membrane (43 Targets) test by the Abcam cooperation. Our data demonstrated that 1-hour and 3-hour incubation treatments with 2 mg aqueous extract of SB induced apoptosis in all cell lines. Additionally, modulation of pro-apoptotic markers (Bad, Bax, p53) and anti-apoptotic markers (BcL-2, p21, FasL) was observed.

P-16   Cameron Mayer (D'Jaris Coles-White, School to the Communication Sciences & Disorders)
The Impact of Technology on the Developing Visual and/or Auditory Memory in School Aged Children
Undergraduate Research Scholar

This study aimed to determine whether time spent on technology impacts the developing auditory or visual memory in school-aged children. A survey was completed with the child participants to acquire a catalog of time spent on both technology devices and non-technological activities. Tests included a visual and auditory memory assessment adapted from the Preschool Language Scales Fifth Edition (PLS-5). The subtests were expanded upon in order to incorporate an auditory element. The results indicated that there was no significance between time spent on technology and visual and auditory memory scores. This was likely caused by the small sample size. However, the researchers did find that the auditory mean scores were significantly different from the visual mean scores across the participant's age range. Consequently, the researchers believe that this area of research could benefit from a similar study with a larger sample size, for specifically the technology element, that continues to assess how auditory and visual memory compare across this age range.

P-17   Adrian Negrea (Anthony Bosman, Mathematics)
Computational Difficulty and Invariants of the Snake Cube Puzzle

The snake cube is a popular puzzle that has been analyzed for its computational difficulty and shown to be NP-complete. Conceiving of the puzzle as a Hamiltonian path in an $n \times n \times n$ graph, we offer a novel mathematical analysis by considering invariants of the puzzle. This allows us to determine necessary conditions for a particular snake cube to be solvable and eliminate a large class of possible puzzles as unsolvable. In particular, we establish upper and lower bounds on the possible number of straight components in solvable snake cube puzzles which exactly determines the number of maximal straight components in the classical $3 \times 3 \times 3$ puzzle.

P-18   Yosia Nurhan (Shandelle Henson, Mathematics)
The Effect of Synchronous Egg-laying on Gull Population Dynamics While Tracking the Egg-laying Order

During years of high sea surface temperature, food resources for glaucous-winged gulls (*Larus glaucescens*) are scarce. In response, male gulls cannibalize the eggs of neighbors. When this occurs, female gulls in dense areas of the colony adopt a tactic called egg-laying synchrony, in which they lay eggs synchronously on an every-other-day schedule. Field observations show that the first-laid egg of each clutch is the most likely to be cannibalized. We analyzed a mathematical model of egg-laying behavior that tracks egg-laying order and found that the system begins to oscillate synchronously when the colony is sufficiently dense. We demonstrated that synchronous colonies produce more eggs than non-synchronous colonies in the presence of cannibalism.

P-19   Janice Pakkianathan (Desmond Murray, Chemistry & Biochemistry)
Synthesis of Novel Temozolomide-Fatty Acid Imide Hybrid Compounds for the Chemotherapeutic Treatment of Glioblastoma Multiforme

Glioblastoma multiforme (GBM) is an aggressive form of brain cancer that originates from glial cells, which make up the supportive tissue surrounding neurons. Temozolomide (TMZ) is the current chemotherapeutic drug administered to treat GBM as it works to inhibit the growth of the cancer cells. This research study focuses on developing a method for synthesizing novel hybrid compounds that combines TMZ with various fatty acids known to have anticancer properties, forming a series of imide compounds with potential chemotherapeutic effects. Once the novel hybrid compounds are successfully synthesized, they will be tested for their anticancer properties on glioblastoma cells.

P-20   Sydney Saint-Jean (Anneris Coria-Navia, Teaching Learning and Curriculum;
Duane McBride, Behavioral Sciences)
Socioeconomic Status and Ethnicity as Predictors of Childhood Career Aspirations

Children discuss their career aspirations from an early age. Studies suggest that there is a relationship between income level and career aspirations. However, there is a gap in the literature that examines relationships between socioeconomic status, ethnicity, grade level, and career aspirations. This study aims to investigate these relationships by surveying students in grades 3, 6, 9, and 11, from diverse neighborhoods. Focusing on students from predominantly Black and White and low and high socioeconomic schools will allow us to discover if there are
multilevel relationships among those variables.

P-21   Daniel Self (L. Monique Pittman, English)
              Anarchism and Masculinity in Homer's Iliad & Doran's Troilus and Cressida
              Undergraduate Research Scholar

This interdisciplinary project employs political philosophy from Stirner, Hobbes, and Nozick to conceptualize the masculinities and politics present in Homer's *Iliad* and Doran's *Troilus and Cressida*. By observing the one-to-one, male-male dominance hierarchies present in Homer's text, Stirner's Ego aptly explains Achilles' rejection of these aforementioned hierarchies. Similarly, Doran's RSC production draws inspiration from *Mad Max: Fury Road*, which opens the play up to Hobbesian state of nature theory and subsequently Nozick's theory of protective associations. Fundamentally, this political philosophy guides a larger discourse regarding the RSC's treatment of heroic masculinities and its consequences for the RSC's younger, male audience.

P-22   Shelbi Slade (D'Jaris Coles-White & Heather Ferguson, School to the Communication Sciences and
              Disorders)
              Graduate Students' Perceptions of Multicultural Counseling in Communication Sciences and Disorders

The United States is becoming a more culturally and linguistically diverse country. However, despite this increase in the cultural diversity of the US only 7.9% of speech-language pathologists identify as racial minorities compared to 28.6% of the US population that identifies as such. A national survey of practitioners indicated that the majority of speech pathologists did not feel fully qualified in the area of cultural competence. As the needs of the US population diversify, the need for strong abilities in Multicultural Counseling (MC) in the field of Communication Sciences and Disorders are necessary. This study assesses the exposure of students in the Masters of Speech-Language Pathology program at Andrews University to observe their perceptions of MC in the field, exposure to MC in their curriculum, and their comfort of engaging in MC in the clinical setting. It is important to see the perceptions of MC in graduate students before they enter the field to see if the next generation of speech pathologists are receiving the proper training they need in MC in graduate school.

P-23   Colleen Staniszewski (Hyun Kwon, Engineering)
              Modeling of COVID-19 Utilizing Various Compartmental Models to Predict Infection Rates Throughout Michigan

Compartmental modeling is a method of employing math to create visual representations of a disease interacting with a select population, typically used in epidemiology analyses. This project applies and adapts compartmental modeling equations to data collected on the deaths, infection, and testing of COVID-19 in Michigan. Comparing current data to past predictive models, as well as the visual representations that were developed through the various compartmental modeling methods, allows assessment of the effects of the preventative measures taken by the state, the various rates at which the infection is able to spread, as well as the potential path and spread of the virus in the future.

P-24   Emma Tennyson (Tom Goodwin, Biology)
              Enamel Corrosion Levels on Squirrel Teeth from the Fox Canyon Locality, Pliocene of Kansas

The enamel of teeth may be corroded after death, especially if the teeth pass through the digestive tract of a predator with low gastric pH. This study characterized enamel corrosion of fossil squirrel teeth from two species (*Otospermophilus rexroadensis* and *Ictidomys meadensis*) obtained from the Fox Canyon locality of Kansas. Using microscopic imaging, I categorized teeth based on corrosion level. For both species, over 40% of specimens exhibited heavy to extreme corrosion, suggesting gastric digestion. There was no significant difference in the distribution of corrosion categories between both upper and lower teeth of either species. Furthermore, there was no difference in the distribution of corrosion categories between the two species.

December Honors Thesis Poster Presentations

D-01   Lloyd Martinez (Jerry Chi, Accounting, Economics & Finance)
The Effective Predictors of the SPX Index

The purpose of this multiple linear regression is to investigate the influence of different variables (Option Difference between Calls and Puts, Volatility Index, Interest Rate on Required Reserves, 10-Year Treasury Minus 2-Year Treasury Spread, ICE BofA Option-Adjusted Spreads (OASs), Gold Currency, and Trade Weighted United States Dollar Index) to explain the variance in closing price of the SPX. The results regressions show statistically significant relationships linking the independent variables to the closing price of the SPX on a daily, weekly, and monthly basis. The forecast error evaluations of the three models suggest that investors can accurately predict financial markets to a certain extent.

D-02   Nathaniel Patterson (Rodney Summerscales, Computing)
Finding an Embedding for Music Auto-Complete: An LSTM Approach

Recent success in sequence generation has been seen in the problem of Polyphonic Music Generation. This study analyzes the effectiveness of two embedding strategies: notes as a string and notes as objects using a Long-Short Term Memory Recurrent Neural Network (LSTM-RNN) for music auto-completion when trained on the corpus of Erik Satie. This project seeks to introduce Music Autocomplete as a new problem, while adding to the body of knowledge on how Neural Networks process sequential data and how different data embeddings improve performance. This project also adds to the subfield of the intersection of artistry and Artificial Intelligence.

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Student Presenters

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Faculty Advisors

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Back image: 2020 AU Honors Scholars (Photo Credit: J.N. Andrews Honors Program)