

FINAL PROJECT- TOPIC AND FOCUS





Final Project (Independent Project)

- Given the research findings you have engaged in your Midterm Project, “Final Project” needs to 1) focus on one specific research problem/issue as reviewed throughout the entire semester and also documented in this PowerPoint file and 2) *implement the codes for a target utility* (which is non-trivial and timely relevance).
- The target application could be something new or could be a reproduction of an existing work.
- It could also be an added value of an AI tool, such as DALL-E or GauGAN to create a piece of display art worthy of something meaningful and most importantly, fun.

Snippet Policy Network for Multi-class Varied-length ECG Early Classification

Yu Huang, Gary G. Yen, *Fellow, IEEE*, Vincent S. Tseng, *Fellow, IEEE*

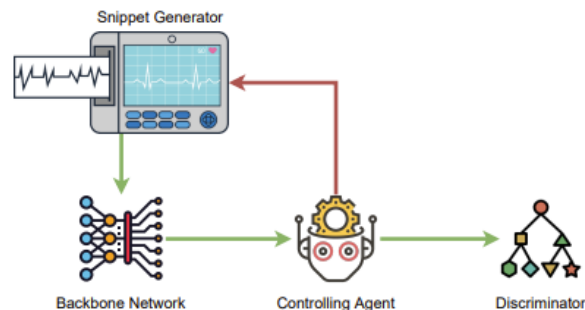
Abstract—Arrhythmia detection from ECG is an important research subject in the prevention and diagnosis of cardiovascular diseases. The prevailing studies formulate arrhythmia detection from ECG as a time series classification problem. Meanwhile, early detection of arrhythmia presents a real-world demand for early prevention and diagnosis. In this paper, we address a problem of cardiovascular diseases early classification, which is a varied-length and long-length time series early classification problem as well. For solving this problem, we propose a deep reinforcement learning-based framework, namely Snippet Policy Network (SPN), consisting of four modules, snippet generator, backbone network, controlling agent, and discriminator. Comparing to the existing approaches, the proposed framework features flexible input length, solves the dual-optimization solution of the earliness and accuracy goals. Experimental results demonstrate that SPN achieves an excellent performance of over 80% in terms of accuracy. Compared to the state-of-the-art methods, at least 7% improvement on different metrics, including the precision, recall, F1-score, and harmonic mean, is delivered by the proposed SPN. To the best of our knowledge, this is the first work focusing on solving the cardiovascular early classification problem based on varied-length ECG data. Based on these excellent features from SPN, it offers a good exemplification for addressing all kinds of varied-length time series early classification problems.

Index Terms—Early Classification, Deep Reinforcement Learning, Cardiovascular Classification



1 INTRODUCTION

IN recent years, the incidence of cardiovascular diseases (CVDs) has practically exploded, which has become a significant threat to human life due to high mortality. Continuous monitoring of CVDs for patients well in advance has been proven an effective measure to save lives. Electrocardiogram (ECG) [1] is a common non-invasive measurement that reflects the physiological state of the heart, and it is one of the most important diagnostic tools in the current age. With the development of smart wearable devices in recent years, patients can acquire ECG devices ubiquitously for personal healthcare monitoring. Although ECG signals are convenient to collect, it remains challenging for medical



- You are **STRONGLY** encouraged to reuse the DNNs that have already been developed/open-sourced and extend it into your own personal use.
- You need to know how to knowledge transfer from one domain to another similar domain (see Homework 4).
- Under the IID constraint, you will still need a sizeable data collected from your specific domain of your interest or a dynamic model to generate data needed. Looking for benchmark data made publicly available.
- We are not shooting for a ready-for-sale end product, but an attempt to 1) demonstrate your learning from this course and 2) begin building something meaningful.
- Build something ***unique*** to your own interest...

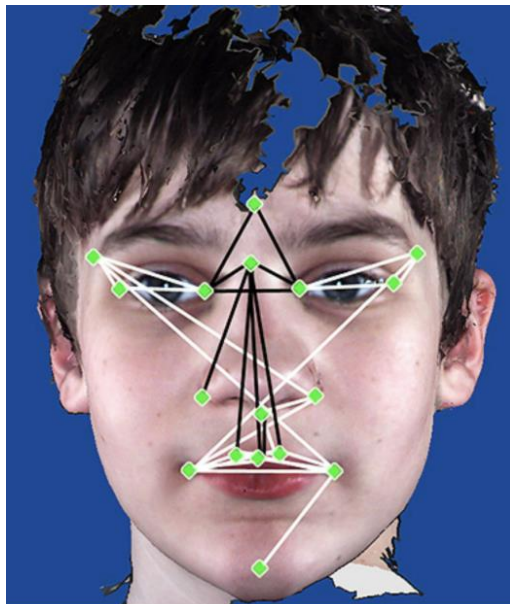
- Step 1 (deadline on March 24, 2023):
 - Propose your final project via email ***to be approved*** by the Instructor, including 1) tentative title and 2) proposed statement of work (exactly what you are going to do in 1~2 sentences).
 - To be submitted and to be graded through Canvas (100 points)
- Step 2 (deadline on **April 30, 2023**):
 - Prepare a 10-minute PowerPoint presentation to detail your research project. To be graded out of 100 points, and
 - Record your own presentation in MPEG format with proper video editing. Please show your face. To be graded out of 100 points.
- Step 3 (optional):
 - 4 × 2 research presentations will be chosen to present live on May 3rd (Wednesday) and May 5th (Friday) lectures. Those selected will be guaranteed to receive final grade “A”.

Candidate Final Projects

- AI in Healthcare applications (11)
 - Oral cancer detection through fluorescent images
 - Skin cancer detection through capture images
 - Breast cancer detection through mammograms
 - Early arrhythmias prediction through ECG
 - COVID-19 detection through x-ray images
 - Dental tooth segmentation
 - Brain tumor segmentation
 - Alzheimer's detection through speech
 - Sign language translator
 - Classify sentiment through images/speech/gait

- Autism detection through facial features

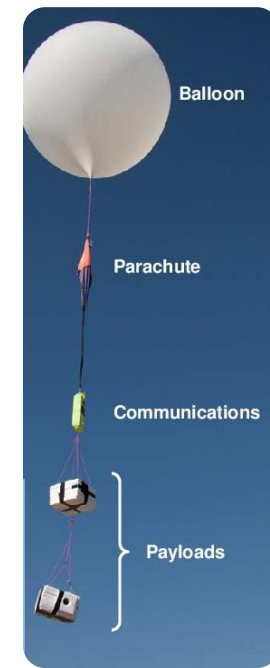
Children with autism have distinct facial features: Study



The study found children with autism had wider eyes, and a "broader upper face," compared with typically developing children. According to the study, children with autism also had a shorter middle region of the face - including the nose and cheeks - as well as a wider mouth and philtrum, the divot above the lip and below the nose.

● AI in Remote Sensing applications (6)

- Weather ballooning remote sensing image enhancement
- Weather forecasting through satellite imaging/Doppler radar imaging
- UAV for traffic surveillance
- Airport's aircraft detection
- Battlefield management
- SAR imaging



● AI in Other Imaging applications (9)

- Dog species classification (crossbred canines)
- Fake face/manga girls' creation
- Gait recognition
- Face detection in airport
- Arabic handwritten character/digit classification
- License plate detection
- Celebrity beautification
- Image captioning
- Traffic sign detection



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● AI in Agricultural applications (8)

- Bird species classification
- Flower species classification
- Insect species classification
- Weed species detection
- Smart sensor
- UAV path planning deployment
- Urban city development
- Bark classification



Smooth
Beech
Fagus sylvatica



Horizontal lenticles
Cherry
Prunus avium



Diamond lenticles
Aspen
Populus tremula



Peeling strips
Silver birch
Betula pendula



Vertical cracks
Hornbeam
Carpinus betulus



Plates
Scots pine
Pinus sylvestris



Intersecting ridges
Ash
Fraxinus



Ridges broken
horizontally
Oak *Quercus*



Curved Ridges
Sycamore
Acer



Fibrous
Sequoia
Sequoiadendron

- AI in Game Playing (4)

- NPC behavior and dialogue design for video gaming
- Chess playing
- Go playing
- AI Foosball



● AI in Sport applications (3)

- Referring in Basketball (e.g., travel and shooting foul detection)
- Assisted in Baseball Batting Training
- Rehabilitation engineering



- AI Recommender applications (4)
 - E-Commerce Customer recommendation
 - Choice of Restaurants
 - Choice of Stocks for Investment
 - Differentiate the music genre



- Making uses of the AI Tools available (8)
 - Exploit Midjourney, an art generator, to create futuristic OSU football stadium
 - Nvidia's Canvas (GauGAN) turns Doodles into Stunning, Photorealistic Landscapes
 - Stable Diffusion or DALL-E (speedup aging/de-aging)
 - Github Copilot (turn text prompt into coding)
 - StatMuse for Big Data Analytics
 - Anime face/character creation
 - Fashion design
 - AI Youtuber (Midjourney + ChatGPT API)

- Addressing Supporting Issues to make AI a better technology (4)
 - AI in Education
 - AI in Social Engineering, crowd sourcing
 - Ethical Issues in AI
 - AI job market and salary survey

List of Approved Topics and Briefs

- **ALALI, Yousef- Crossbred Canines Species Classification**
Design a classification to identify species based on height, color, name and other deciding factors extracted from images
- **ALENEZI, Abdullah- Traffic Sign Detector**
Develop a CNN based traffic sign detector that is ready for autonomous vehicle
- **ALKANDARI, Abdulrahman- Arabic Character Recognition**
Design a tool to recognize Arabic based characters
- **ALKHARAZ, Mohammad- Emotion Recognition from Facial Image**
Focus on emotion recognition system that can identify different emotions of individuals from facial expressions.
- **AQUINO, Jason- License Plate Detection**
Developing an AI system that can recognize license plates in images and convert the images to text

- **BAUCOM, Seth- Deepfake in AI**

Evaluate philosophically how DeepFake has affected the AI world and how to eradicate the discrepancy of fake media.

- **BEHM, Brett- Llama Caption Creation**

Edit a short transcript into the formatting of a caption and a large language model based on Facebooks llama will train itself to edit large scale files to raw transcripts into the same formatting to ease the load of captioners.

- **BROWN, Justin- Handwriting Math Recognition**

Develop an AI based model that can determine and classify handwritten mathematical expressions.

- **BUHMAD, Hussein- Face Recognition**

Developing a CNN with data available from V7 for face recognition

- **CURTISINGER, Coleman- American Sign Language Translator**

Design a CNN to do the translation from frame captured from video footage into sign language letters

- **DeSANTIS, Max- GA adapted NPC Behavior**

Exploiting Unreal Engine 5 to create a predator/prey scenario where the GA adapts behavior to optimize for population size and average lifetime of both species.

- **DEVLIN, Isaac- Oklahoma Weed Detector**

Utilizing a weed detector program that is on GitHub and attempt to add new Oklahoma plants to the dataset and then apply the program

- **EVERHEART, Daniel- Lego Brick Detector**

Creating a specialized dataset through some data labeling tool from Github, to find a specific lego brick as needed

- **FATON, Seraphin- AI Job Markey Survey**

Survey AI job opportunities, skillset requirements and their pay scales in local area (Oklahoma and Texas), in the nation and around the world.

- **FOISTER, Jaymy- Melanoma Monitor**

Use of the trained data provided by the Stanford to recreate an app (SkinSkan) for skin cancer detection through capture images

- **GREEN, Hunter- Bird Species and Gender Classification**

Identify species of birds and its gender or add a new species to an already trained CNN.

- **GULLIC, Jade- Small Dog Breed Classification**

To develop an AI to recognize the breed of a small dog given an image (and maybe videos, too)

- **HALE, Christopher- Object Detection**

object detection for unmanned ground vehicle autonomy, including detection of cars, people bikes, animals and other basic things that might interfere with an autonomous vehicle.

- **HILL, Brendan- Frame Rendering**

AI learns to generate extra frames in a video, say from 24fps to 60fps.

- **HOLSAPPLE, Keenan- Project Hawk**

Using DNN Object Detection and A* navigation for determining solvable path for car in changing maze.

- **HOWARD, Gage- American Sign Language Translator**

Create an AI tool (e.g., making use of GISLR and ASL Dataset along with ChatGPT) that can translate photos or videos of sign language into an English sentence.

- **HOWELL, Steven Jr- Alzheimer's Detection Through Speech**

Use the Dementia Bank dataset to recreate and improve upon already created models for Alzheimer's and Dementia recognition.

- **JEFFRIES, Jax- Movie Recommender System**

This project will take an input movie or movies from a user and return several movies that the system recommends.

- **JOHNSON, Zach- Open Wildlife**

Leverage the “Wild Me” database, Microsoft's open-source AI that identifies and tracks wildlife, and reproduce its wildlife identification network

- **KIDD, Thomas- Plant Disease Recognition**

Exploiting the PlantMD model to expand its capabilities to recognize other plants that are diseased from the PantNet300.

- **LARSH, Logan- Cell Comm AI**

Cellular Link Optimization, Maintenance, and Monitoring with Advanced AI Intelligence

- **MOSER, Christian- Atrial Fibrillation Detection through ECG**

Build a CNN that accepts ECG to identify AFib (atrial fibrillation)

- **OWENS, Robert III- Facial Features**

Taking the human head (picture or live footage) and the user can “customize” it on the app or website. Customizations include changing hair (design and color), eyes, and the other features of the head.

- **PATEL, Jaden- Gender Recognition**

Utilizing OpenCV and CNN trained by pre-labeled datasets of men and women from an online database to create a real-time gender recognition system

- **ROLPH, Kaylee- Tick Classification**

Built on Github TickIDNet, the program will be built using a variety of pictures of different ticks found in the US and after it has identified the type of tick it will give the reader a list of possible diseases the tick could carry.

- **ROOKER, Zarek- Spotify Playlist Generator**

Generating Spotify Playlists based on user input and categorization of data.

- **ROSEN, Aaron- Plant Classification**

This AI system will take in images of plants and determine the plant name, up to 10-15 common house plants.

- **SAGER, Carson- Referring in Basketball**

plan to collect data training and testing data from a proper database of images of rule violations and use this model to predict referee calls.

- **SCHWICKERATH, Brendan- AI Generated Music**

Develop a neural network that will generate simple musical pieces that will resemble music made by a human

- **SNAPP, Jayden- AI for Video Gaming Experience**

Building an AI companion that will learn the controls and mechanics of a basic game, such as Galaga, in order to assist a solo player to achieve victory.

- **STOLFA, Joey- Real Voice**

When a user speaks, the AI will retrieve the corresponding phonemes from the database and replace the user's phonemes to effectively copy the sound of the desired voice.

- **TAYLOR, Matthew- Music Recommender**

perform sentiment analysis on a user prompt, and recommend a song to the user.

- **TRAN, Kelvin- Object Tracking in a Video Game**

This will aid the player in aim assistance in video games by moving the crosshair towards a target. This is useful for video game consoles that lack fine aiming.

- **VICH, Jimmy- AI Assisted Agriculture**

To estimate the amount of grass distribution and provide a recommendation on what fertilizers and herbicides are needed on a rancher's pasture through image capture through drone

- **WARD, Remington- AI Assisted Snake Game**

Building the Snake Game through Python to allow training an AI agent to search for an optimal path in an obstacle environment

- YOUNG, Reginald- AI Arrhythmias Prediction

Using physiological data, such as ECG, to predict heart arrhythmias