



College of Engineering

CS CAPSTONE PROGRESS REPORT

FALL 2019

BUILDING MORE SELF-AWARE EVERYDAY ROBOTS

PREPARED FOR
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PREPARED BY
GROUP 43
COMEDY ROBOT TEAM

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Abstract

This document provides a summary of the progress made during Fall term on the 'Building More Self-Aware Everyday Robots' Capstone project. It examines the research and planning work done so far in relation to the established project goals and gives the plan for what will be done over the break in preparation for proceeding to implementation.

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1 PURPOSE AND GOALS

The purpose of our project is to study how human-robot interactions can be improved by observing the ability of a robotic stand-up comedian to read and respond to cues from its audience. Our goals are to use machine learning on a dataset of recordings from previous comedy performances to train models for detecting laughter and using that response to decide whether a joke was a hit or a bomb.

This analysis can be used by the robot to make real-time adjustments to its performance based on the perceived audience preferences in order to improve the success of their interpersonal communications. The work also has potential applications outside the field of comedy in improving the experience of interactions with AI assistants and other autonomous systems.

2 CURRENT STATUS

We have met with our client several times over the course of the term to discuss the project scope, deliverable goals, and details of implementation. We have done background reading on the origin of the project and the robot team's previous work and identified where our capstone project will build on their work to advance the overall project. Our client has provided the dataset of recordings and joke classifications we will be working with and we have reviewed the files to become familiar with the data documentation and labeling. We have conducted research into various methods of machine learning and noise suppression that could potentially be used for our work and examined the specs of the Nao V6 robot to determine what can be accomplished with the provided hardware. We have completed all project planning and documentation assigned for the term and the documents were sent to our client for review and verification to proceed to implementation next term, which has been granted.

3 PROBLEMS AND SOLUTIONS

To implement the machine learning we need to learn to use the SciKit library in Python, requiring familiarity with other libraries including Numpy, Panda, and Matplotlib. We have purchased a Udemy online class to learn and experiment with those libraries over break.

A lot of machine learning knowledge is required, including statistics and math concepts we need to learn such as logistic regression and curve fitting. Three of us are taking ST421 this term, which connects to much of the related knowledge. The Udemy class also has a few lessons about it.

The Nao robot's hardware places limits what level of processing can be accomplished in real time, particularly for noise suppression. This is somewhat processor intensive and may not be able to run well onboard the robot. We are searching for lightweight applications to use in performing the audio processing to prevent overloading the robot's capabilities.

4 WEEKLY PROGRESS SUMMARY

Week 1:

- Met group members
- Established team communication system and standards
- Conducted initial research into project background

Week 2:

- Contacted client to make introductions
- Wrote individual Problem Statements
- Met with client to discuss project details and definite goals and breakdown of the specific tasks involved
- Attended a performance by the robot to observe the project in action

Week 3:

- Received dataset from client
- Received project documentation and research paper from client
- Wrote first draft of the Requirements Document and sent to client for review
- Received email from client with additional details on project scope and desired deliverables
- Wrote the group Problem Statement

Week 4:

- Continued background reading on the project and related research from client's resources
- Finished the Requirements Document

Week 5:

- Researched technology options for various tasks involved in the project
- Wrote first drafts of individual Tech Reviews recommending initial approaches to the tasks
- Met with client to detail task breakdowns and their applications to the project goals

Week 6:

- Received email from client with additional sources for research into past studies of project-related concepts
- Finished the Tech Reviews
- Met with client to further discuss project deliverables

Week 7:

- Wrote first draft of the Design Document
- Met with client to discuss plans for preparation of initial implementation

Week 8:

- Finished the Design Document
- Sent the Design Document to client for review
- Began research into application of the methodologies selected in our Tech Reviews

Week 9:

- Continued methodology research and implementation preparation

Week 10:

- Provided project documentation to client for review and secured approval of work done so far
- Held final meeting with client to discuss research and preparations to be done over break to make ready for proceeding to implementation next term
- Wrote the Fall Term Progress Report

5 RETROSPECTIVE

Task*	Positives	Deltas	Actions
1	Read documents provided by client for background and attended a performance by the robot	Hard to find past work on laughter detection in audio, most studies are for voice detection or music	Conduct ongoing research into related work in audio analysis
2	There is a good amount of data to work with	Most of the data is from the previous version of the Nao robot	Work with the V5 data first to establish a functional model then proceed to use the V6 data
3	Received guidance from client on which options were most appropriate for this usage	Must identify which learning method is best for our data, keeping in mind the requirement that it must be able to run in real-time in the end result of our work	Run the audio analysis using each learning method and compare the results to determine the most successful application
4	Looked over the robot team's current implementation	May need to make room for additional preprocessing such as noise suppression	Replicate the current implementation to produce a working base system then introduce noise suppression functionality and gauge any affect on performance
5	Purchased Udemy course to get up to speed on machine learning	Must familiarize with the learning process and how new methods can be implemented and tested	Conduct research over break into different learning methods and read about implementation with SciKit
6	Python library was found which can be used for our needs and an initial implementation was prepared	The library may prove to be too processor intensive for real-time usage	Observe processor requirements of the library in use and modify to be more lightweight if needed

* Task List for Fall Term:

Task 1: Familiarize with project background

Task 2: Examine the dataset of recordings and documentation

Task 3: Research machine learning options

Task 4: Set up for interfacing with the dataset

Task 5: Prepare for machine learning implementation

Task 6: Prepare for noise suppression implementation