ASL Sign Language Translation

Beard, Bennion, Carlson, Napolitano

Data Science Capstone Project
Launch Report

Date:

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Team Members:

Name: Tyler Beard

Name: Adam Bennion

Name: Zach Carlson

Name: Andrew Napolitano

The System/Product

System/Product Name: American Sign Language (ASL) Alphabet Translation Engine

Introduction:

Among the most powerful use cases of technology are those that make the world more habitable and enjoyable for all. Products and applications to enhance the lives of the handicapped can have truly life-altering impacts. The goal of this project is to research computer vision algorithms that would enable the real-time translation of American Sign Language to connect individuals where language barriers have historically existed. The primary deliverable would include a model that can be deployed to consume and translate real-time sign data and produce text outputs.

Highlighted Features:

- Base goal: translate 24 sign letters of the alphabet images
- Stretch: 26/27/28 signs (if space or period included) images
- Extra stretch: Live translation of 24-28 signs (using an existing library such as https://pypi.org/project/pyttsx3/)

Sponsor or Proxy User:

Due to the limited scope of the project, future work including the entirety of ASL would likely be necessary for potential users. Potential uses include one-on-one communication with deaf individuals restricted to ASL. If utilized in a mobile application, this technology could greatly advance deaf individual interaction with the general populace.

Issues:

Although American Sign Language does not contain as many distinct words as the English language, it still boasts over 10,000 individual signs (compared to an English dictionary which contains about 180,000 words).[1] As such, there could be upwards of 10,000 classes to train a model to detect. Of course, the sheer volume of potential classes presents a challenge both in collecting ample training data and producing a well-calibrated model.

[1] https://www.lifeprint.com/asl101/fingerspelling/fingerspelling.htm

Secondly, sign language frequently includes signs that require motion. This presents an additional challenge for training a model as one class may have *n* numbers of acceptable still-frame positions, where *n* is an expansive value that is dependent on the framerate of capture and length of the sign motion.

Thirdly, the real-time capture of video imaging can present challenges associated with false inputs. The model will have to be able to identify noise as well as it identifies individual signals.

Fourth, acquisition may be difficult without introducing our own new dataset generated by the team or using existing datasets. Initial search engine results seem insufficient for training.

Finally, colors in images may have a significant effect on the classifier, which could lead to poor real-world performance. To combat this, sufficient sample variation is desirable. Obtaining sufficient sample variation for this project will be difficult, therefore pre-processing and acquisition will likely include methods to generate additional samples via manipulation of the original dataset.

The Team

Team Name: Ultra Science Squadron

Team Members and their specialties:

Tyler Beard: Tyler has a career as a software engineer with over 10 years experience of work in the field. Strong coding skills will help in the data pre-processing, EDA, modeling and model deployment tasks. Having taken Deep Learning will help in focusing on the modeling portion of the project.

Adam Bennion: Adam is a software engineer with 4 years of professional experience and can contribute to all scripts required in the project. Adam will specialize in acquisition for the first portion of the project, then aid in classifier development in the second half. Adam has experience with web-scraping which could be used in data acquisition if necessary. He also has Machine Learning and Deep Learning course experience.

Zach Carlson: Zach has a career as an analyst in both research and industry settings with 4 years of experience in project design, EDA, and data visualization. They'll help with data acquisition, data pre-processing, model development, and repository documentation and management.

Andrew Napolitano: Andrew has a career in cyber security and data analytics consulting with a strong background in data visualization, modeling, team management, and communication. Andrew will be specializing in the data pre-processing/cleaning, EDA, modeling, and model deployment tasks of the project as well as having a role in managing the team towards meeting its scheduled commitments.

Team Communication:

The team has established strong real-time asynchronous communication channels via email and text messaging with synchronous remote sessions held via video conferencing technology at least once per week, the day changing to accommodate all team members. The team shares documents on a shared Google Drive. The project will also be stored on a public Github repository.

Team Issues:

Not all team members have taken Deep Learning courses and will thus need to find tutorials and educational material to fill knowledge gaps. We have found several tutorials linked here and here, as well as a full Github implementation linked here.

In addition to this, all team members are remote asynchronous students and are not all available mid-day on Fridays for in-class presentations. Further discussions with the professor and team members will be required to address this.

Table of Contributions

The table below identifies contributors to various sections of this document.

	Section	Writing	Editing
1	**Project**	AN, AB	AN, TB, AB
2	**Team**	All	All
3	**Plan**	AN, ZC, AB	AN, ZC, TB

Grading

The grade is given on the basis of quality, clarity, presentation, completeness, and writing of each section in the report. This is the grade of the group. Individual grades will be assigned at the end of the term when peer reviews are collected.