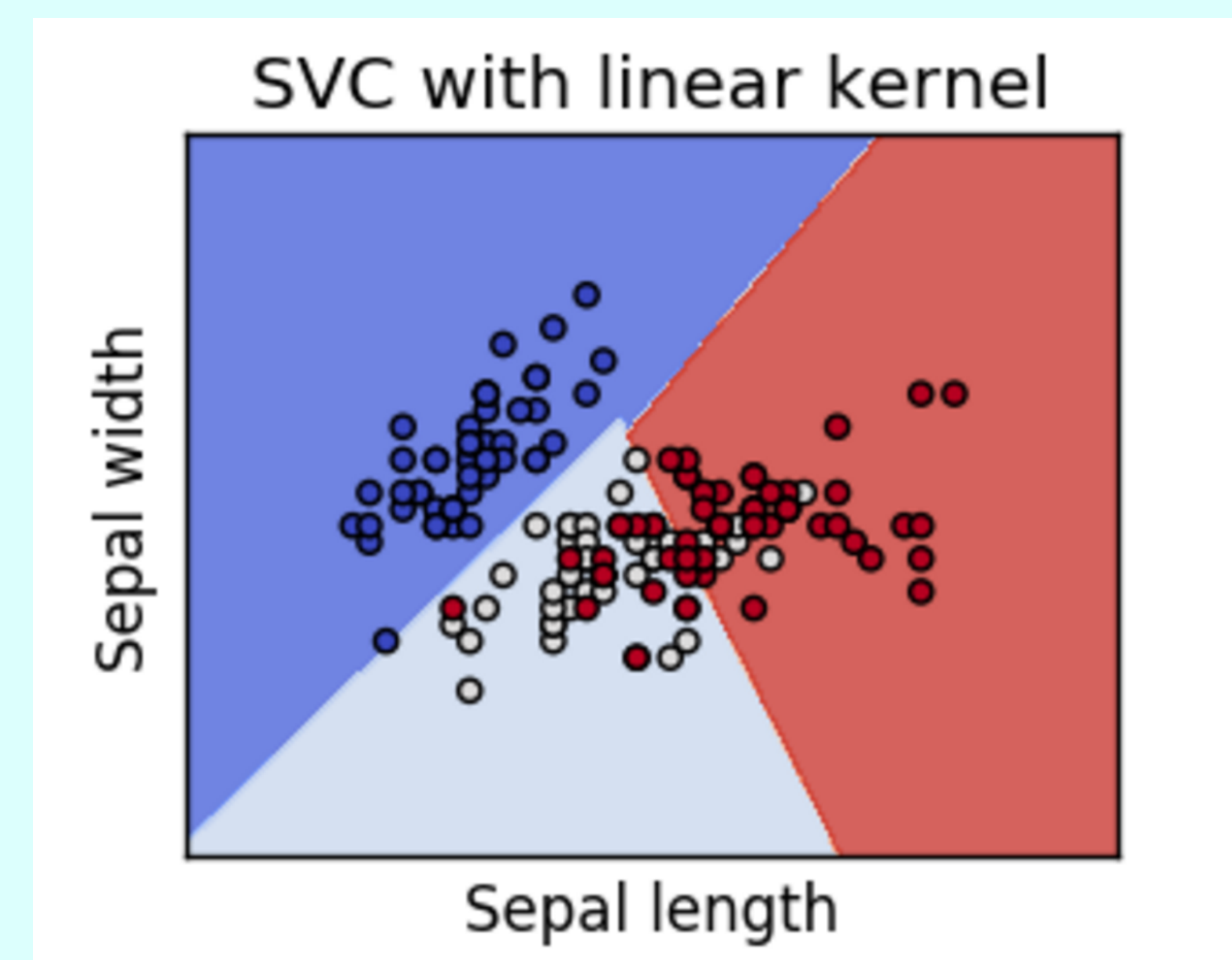


Voice

Sign Language Translation System

Theory



Design Considerations

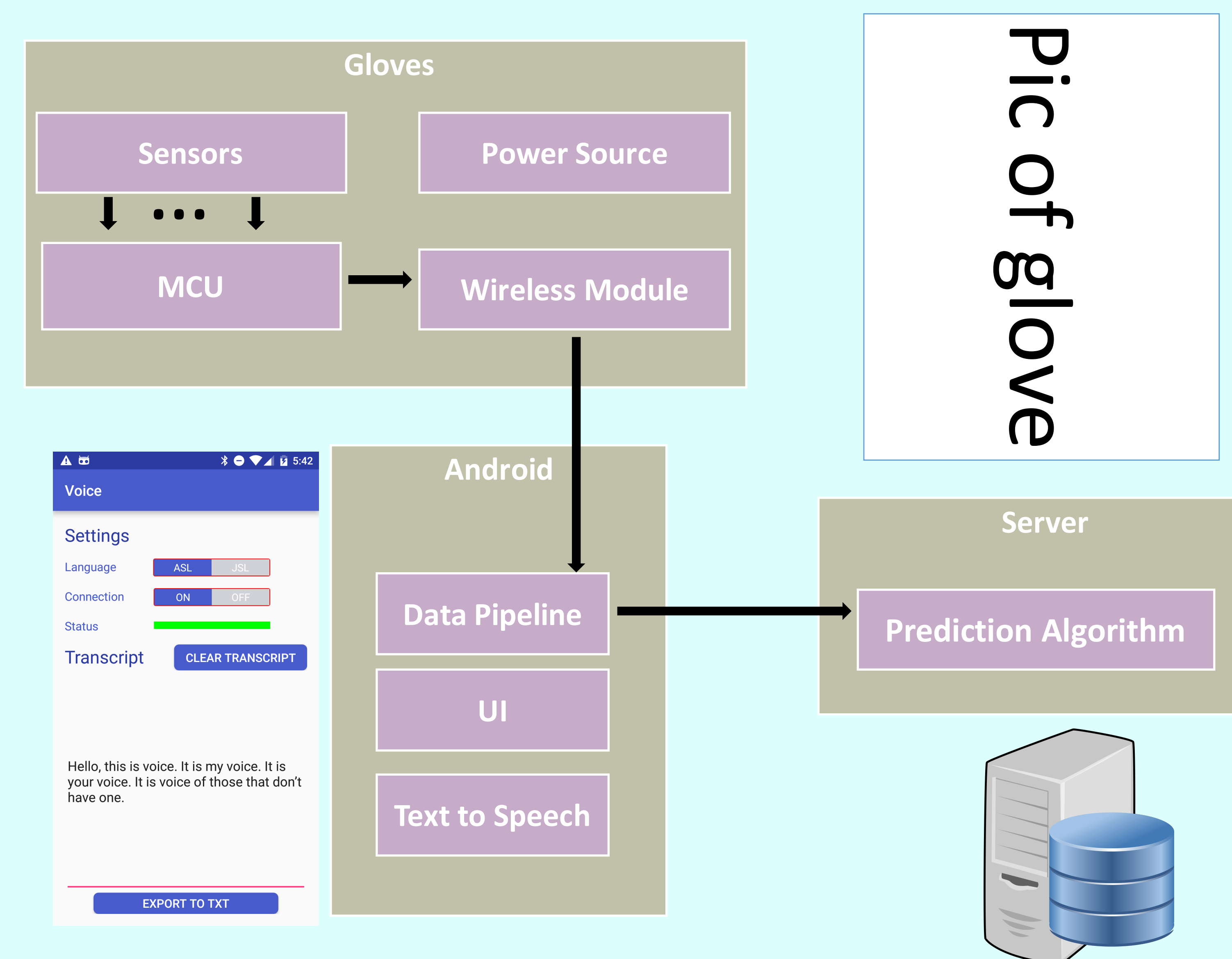
- Computer vision (requires a camera, very difficult to capture just a person's hands in changing environments)
- Data gloves (very expensive)
- Support Vector Machines vs. Naive Bayes vs. Decision Trees (SVM has highest accuracy)

Acknowledgements

- Group Members: Akshay Budhkar, Eliot Chan, Biraj Kapadia, Amish Patel
- Consultant: Dana Kulić
- Course Coordinator: Dan Davison

[1] "Statistics on deaf Canadians," Canadian Association of the Deaf, 2015. [Online]. Available: <http://cad.ca/issues-positions/statistics-on-deaf-canadians/>.
[2] T. Harrington, "Deaf population of the U.S. - Local and regional deaf populations," Gallaudet University Library, 2010. [Online]. Available: <http://libguides.gallaudet.edu/content.php?pid=119476&sid=1029190>.
[3] "Plot different SVM classifiers in the iris dataset — scikit-learn 0.18.1 documentation", Scikit-learn.org, 2017. [Online]. Available: http://scikit-learn.org/stable/auto_examples/svm/plot_iris.html.

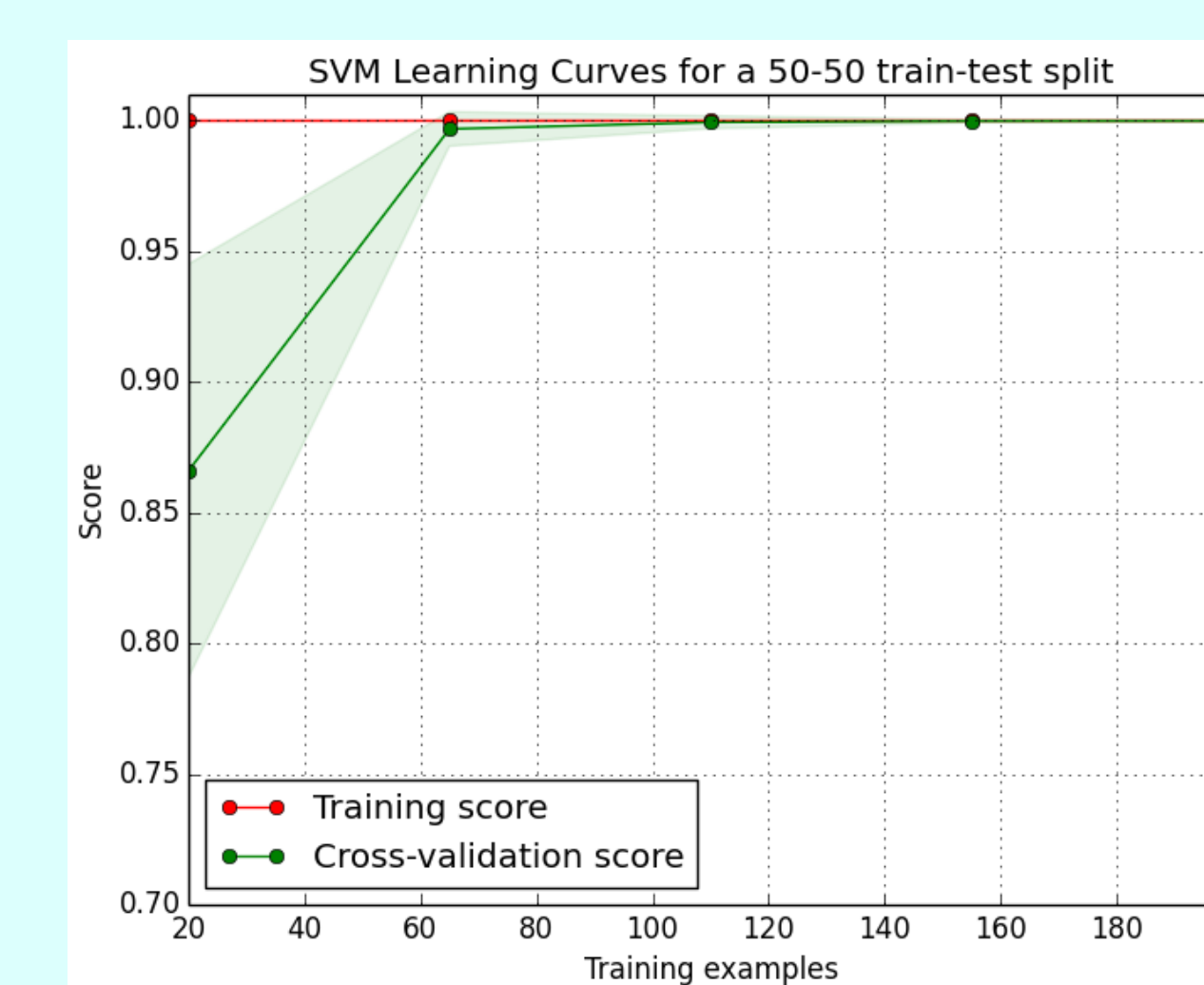
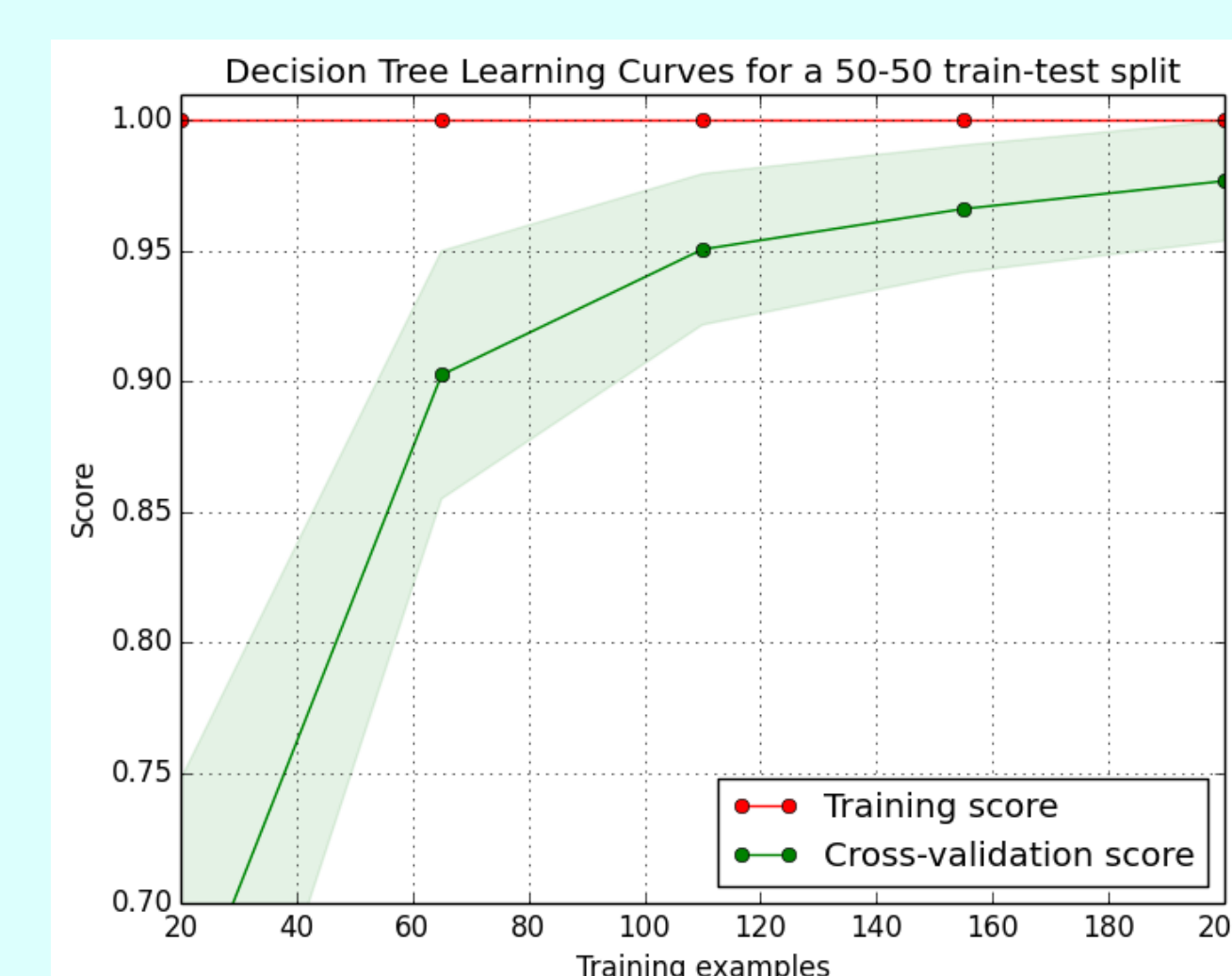
Principle of Operation



Results and Analysis

- Machine Learning (ML) models were trained on 100 iterations/sign of three users and used to predict on 100 iterations/sign of one user to calculate accuracy
- Logistic Regression and Support Vector Machines (SVM) perform better than other ML models like Naive Bayes and Decision Tree Learning
- More the input data, better the accuracy of the models. SVM converges with fewer iterations and a higher accuracy compared to Decision Tree Learning as seen in the graphs below

| Model Name | ASL (15 Signs) | JSL (20% of the symbols) |
|---------------------|----------------|--------------------------|
| SVM | 96.3% | 100% |
| Logistic Regression | 99.6% | 100% |



Motivation

- ~1,500,000 culturally deaf in the United States and Canada [1][2] with no efficient and natural way to communicate with the hearing
- Communication barriers between sign language speakers and the general populace remain high

Objective

- Build a system to allow sign-language speakers to communicate with non-speakers in an unobtrusive and natural way
- Support a subset of two sign language dialects, namely American Sign Language and Japanese Sign Language

Advantages

- Allows users to speak in sign language in a mobile environment
- Portable and minimal setup time
- Easily integrated into daily routine

Features

- Supports 15 American Sign Language (ASL) signs
- Supports ~20% of Japanese Sign Language (JSL) symbols
- Theoretical accuracy of over 99%
- Weighs under X grams
- Can run for more than 10 hour on a single charge