Sign Language Portable Interpreter (SLaPI)

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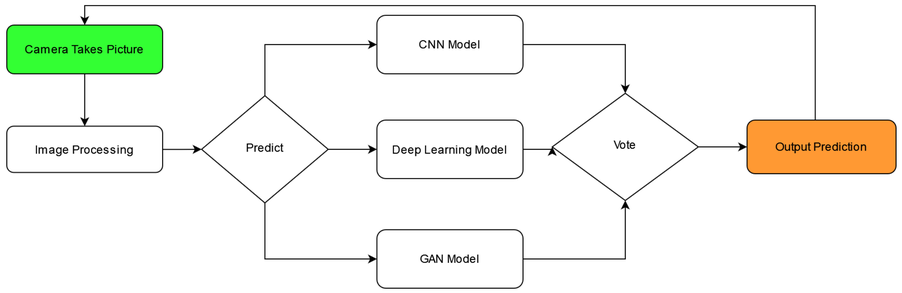
Abstract

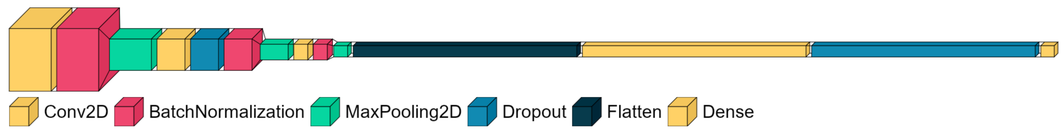
The Sign Language Portable Interpreter (SLaPI) is a compact interpreter for American sign language. SLaPI uses computer vision and artificial intelligence algorithms to translate gestures into English text, streamlining communication between the deaf and the hearing. The device is compact and lightweight so that it is easy to pick up and move to wherever an interpreter is needed.

Methods and Materials

SLaPI uses an ensemble method for gesture detection. This means that there are three classifiers each looking at the image data and individually voting for what gesture is in the frame. The model takes a majority rule vote from the classifiers: whichever gesture gets the most votes must be the right answer. The three classifiers are a Convolutional Neural Network (CNN), a deep learning model, and a Generative Adversarial Network (GAN).



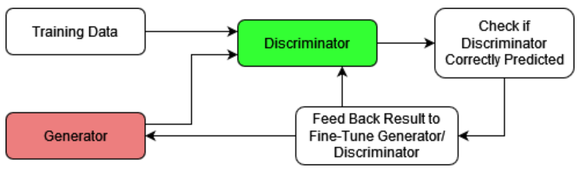
Decision Making Flowchart



CNN Model Layers

Background

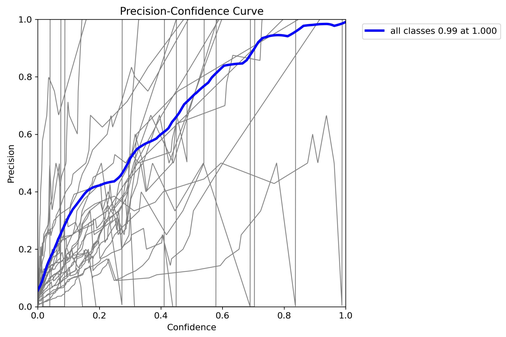
- ASL stands for American Sign Language
- Gesture recognition is an ongoing problem for the field of computer vision and machine learning.
- By combining multiple models into one ensemble model, a higher overall accuracy is achieved.

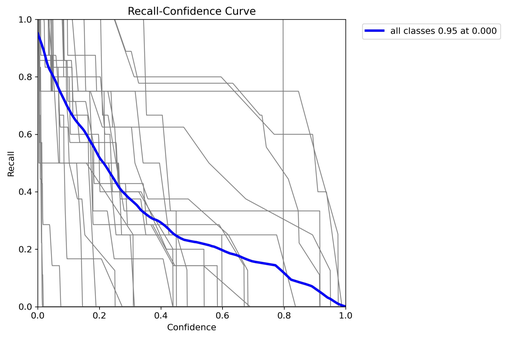


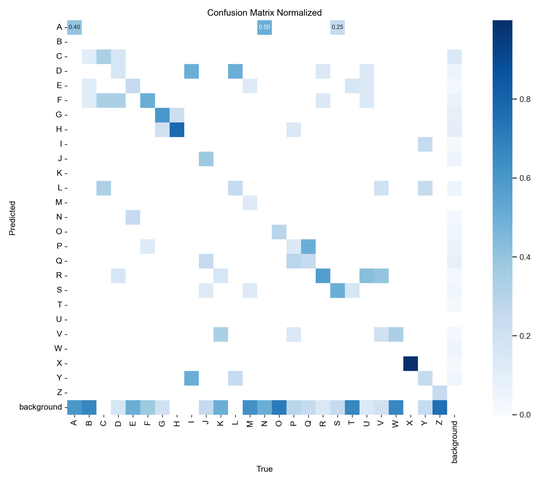
GAN Model Training Process

Results

SLaPI shows a lot of promise and is able to predict gestures accurately. Each model is able to accurately predict the 24 ASL alphabet gestures. However, all models struggle when handed novel data and confuse signs.







Future Direction

The next feature to add would be temporal encoding. This would allow SLaPI to interpret ASL gestures that incorporate movement, greatly improving it's usefulness. Additionally, the original vision was to have this running on an embedded system, like an Nvidia Jetson. This would allow the device to be more mobile without compromising on processing power.

References

[1] datamunge Tecperson, "Sign language mnist," Kaggle, https://www.kaggle.com/datasets/datamunge/sign-language-mnist (accessed May 31, 2024).

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