# American Sign Language Translation

Diana Ha

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# Overview

## Purpose

To create a translator of American Sign Language (ASL) letters

## Relevance

- Assist the vocally- or hearing-impaired in communicating with those who have little to no knowledge of ASL
- Allow beginners to learn the ASL alphabet
- Can be applied to other image recognition projects

# Model Inputs

24 letters,
excludes J and Z

Train:
27,455 images

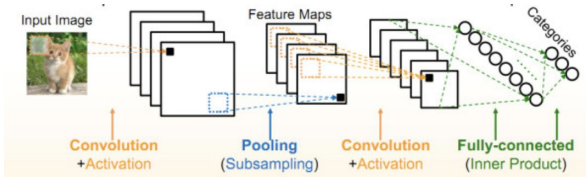
Test:
7,172 images

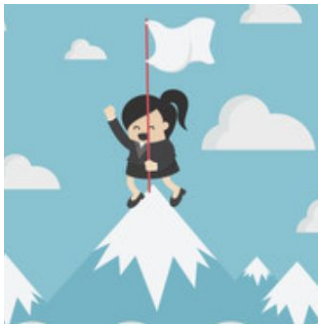
# Model Creation Process

Format images into dataframes of pixels

| | label | pixel1 | pixel2 | pixel3 | pixel4 | pixel5 |
|---|---|---|---|---|---|---|
| 0 | 6 | 149 | 149 | 150 | 150 | 150 |
| 1 | 5 | 126 | 128 | 131 | 132 | 133 |
| 2 | 10 | 85 | 88 | 92 | 96 | 105 |
| 3 | 0 | 203 | 205 | 207 | 206 | 207 |
| 4 | 3 | 188 | 191 | 193 | 195 | 199 |

Run image data (train) through CNN model



Have model output prediction when given an image

Tune model to improve accuracy on test data

# Image to Dataframe

Letter of the alphabet represented as a number

Each column contains one pixel of an image

Each row represents an image

| | label | pixel1 | pixel2 | pixel3 | pixel4 | pixel5 | pixel6 | pixel7 | pixel8 | pixel9 | ... | pixel775 | pixel776 | pixel777 | pixel778 | pixel779 | pixel780 | pixel781 | pixel782 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 3 | 107 | 118 | 127 | 134 | 139 | 143 | 146 | 150 | 153 | ... | 207 | 207 | 207 | 207 | 206 | 206 | 206 | 204 |
| 1 | 6 | 155 | 157 | 156 | 156 | 156 | 157 | 156 | 158 | 158 | ... | 69 | 149 | 128 | 87 | 94 | 163 | 175 | 103 |
| 2 | 2 | 187 | 188 | 188 | 187 | 187 | 186 | 187 | 188 | 187 | ... | 202 | 201 | 200 | 199 | 198 | 199 | 198 | 195 |
| 3 | 2 | 211 | 211 | 212 | 212 | 211 | 210 | 211 | 210 | 210 | ... | 235 | 234 | 233 | 231 | 230 | 226 | 225 | 222 |
| 4 | 13 | 164 | 167 | 170 | 172 | 176 | 179 | 180 | 184 | 185 | ... | 92 | 105 | 105 | 108 | 133 | 163 | 157 | 163 |
| 5 | 16 | 161 | 168 | 172 | 173 | 178 | 184 | 189 | 193 | 196 | ... | 76 | 74 | 68 | 62 | 53 | 55 | 48 | 238 |
| 6 | 8 | 134 | 134 | 135 | 135 | 136 | 137 | 137 | 138 | 138 | ... | 109 | 102 | 91 | 65 | 138 | 189 | 179 | 181 |
| 7 | 22 | 114 | 42 | 74 | 99 | 104 | 109 | 117 | 127 | 142 | ... | 214 | 218 | 220 | 223 | 223 | 225 | 227 | 227 |
| 8 | 3 | 169 | 174 | 176 | 180 | 183 | 185 | 187 | 188 | 190 | ... | 119 | 118 | 123 | 120 | 118 | 114 | 94 | 74 |
| 9 | 3 | 189 | 189 | 189 | 190 | 190 | 191 | 190 | 190 | 190 | ... | 13 | 53 | 200 | 204 | 201 | 201 | 193 | 175 |
| 10 | 18 | 133 | 135 | 141 | 146 | 150 | 155 | 158 | 159 | 163 | ... | 99 | 96 | 96 | 97 | 96 | 95 | 94 | 94 |
| 11 | 10 | 0 | 25 | 38 | 40 | 41 | 46 | 50 | 56 | 69 | ... | 129 | 85 | 60 | 64 | 72 | 70 | 67 | 65 |
| 12 | 16 | 87 | 91 | 99 | 116 | 132 | 142 | 147 | 153 | 160 | ... | 176 | 192 | 128 | 22 | 3 | 4 | 4 | 1 |
| 13 | 22 | 80 | 98 | 121 | 39 | 53 | 94 | 100 | 107 | 110 | ... | 234 | 229 | 234 | 235 | 238 | 241 | 242 | 244 |
| 14 | 20 | 127 | 127 | 128 | 130 | 132 | 133 | 133 | 133 | 135 | ... | 49 | 151 | 154 | 151 | 150 | 149 | 147 | 145 |
| 15 | 16 | 86 | 87 | 89 | 93 | 104 | 114 | 122 | 131 | 137 | ... | 252 | 244 | 238 | 244 | 229 | 157 | 85 | 122 |

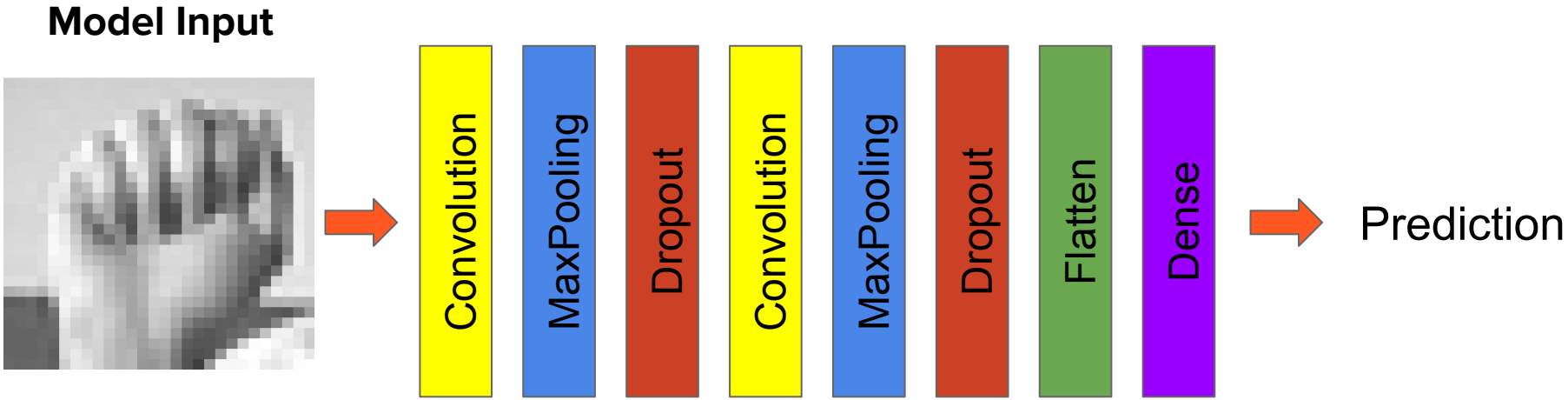
**MNIST dataset**

784 columns

28x28 images

[Kaggle: Sign Language MNIST]

# Convolutional Neural Networks (CNN)



# Next Steps

- Increase sample size and diversity
- Incorporate common ASL words and phrases (and include letters J and Z)
- Translate via laptop webcam
- Improve processing time
- Add layers in CNN to improve accuracy