PERSONALIZED ALERT SYSTEM

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PROBLEM CONTEXT

- Alert needs to be triggered for a desired event/set of events

- In this case a dog entering or exiting it's crate should trigger the alert

Personalized Alert System Uses

- No simple mechanical solutions
- Situation specific to user

Examples – baby escaping their crate, monitoring a snack self

SOLUTION

- Here we will develop only a model to classify desired outcomes
- Embed finished model in complete system for a final product
- Leverage Neural Network models

DATA COLLECTION

Step 1

Take separate videos each representing a class

- In crate
- Out of crate
- Being taken out/put in crate

Step 2

- Parse videos into individual images
- Class of image is determined by video it came from

Step 3

Reformat images and save

- Convert to greyscale
- Resize to lower pixel count
- Save to set of CSV files

BENCHMARK MODEL

- Neural Networks usually have great performance for complex tasks such as image classification
- Use a Random Forest Classifier to measure performance of a more standard, lower overhead algorithm

METHOD

- Use PCA to reduce dimensionality to 10
- Tune multi-classifier Random Forest model through Grid search methods

Test Accuracy	88%

DENSE NEURAL NETWORKS

- Began by training Neural Networks with Dense Layers
- Most basic layer – nodes are fully connected
- Updates to model over many iterations of data set

- Performed well above benchmark

Performance on test data

- Top Training Performance – 98%
- Average Converged Performance – 93%

- Inconsistent performance over epochs

ADJUSTMENTS

Data organization changed in an attempt to improve inconsistency

Aggregate data into fewer files and shuffle

- More data per model update
- Multiple classes per model update

Correlated images removed from training and testing data

- Video data in testing removed from training data
- Prevent overfitting during training

DENSE NEURAL NETWORKS II

Experiment with varying DNNs

- Vary nodes per layer
- Vary number of layers

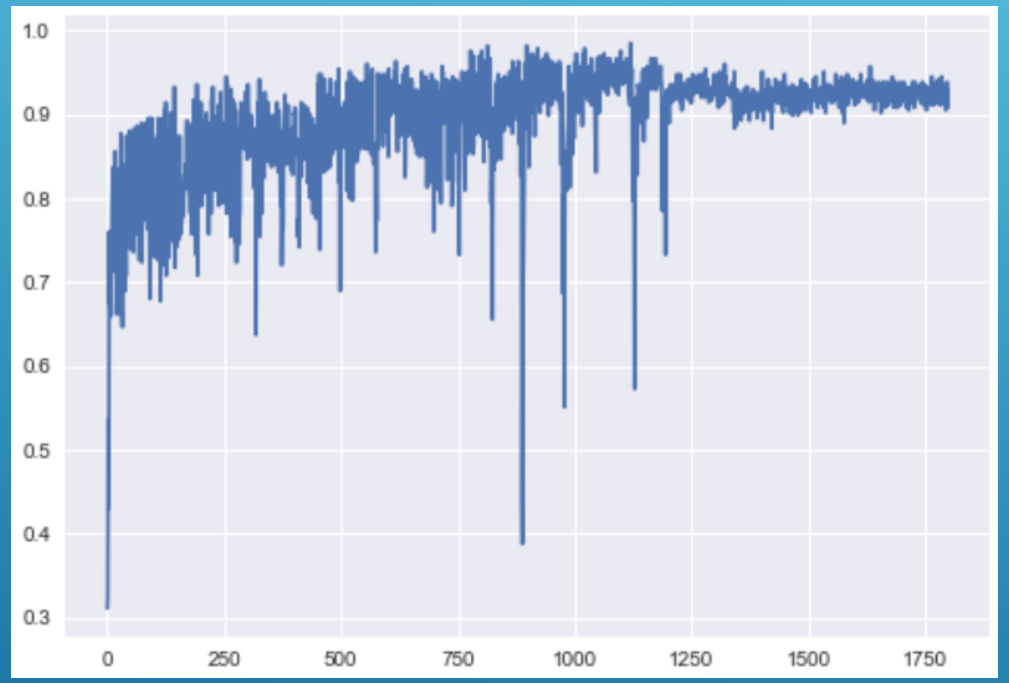
- Train each one with new data organization
- 150 iterations of data

Performance on test data

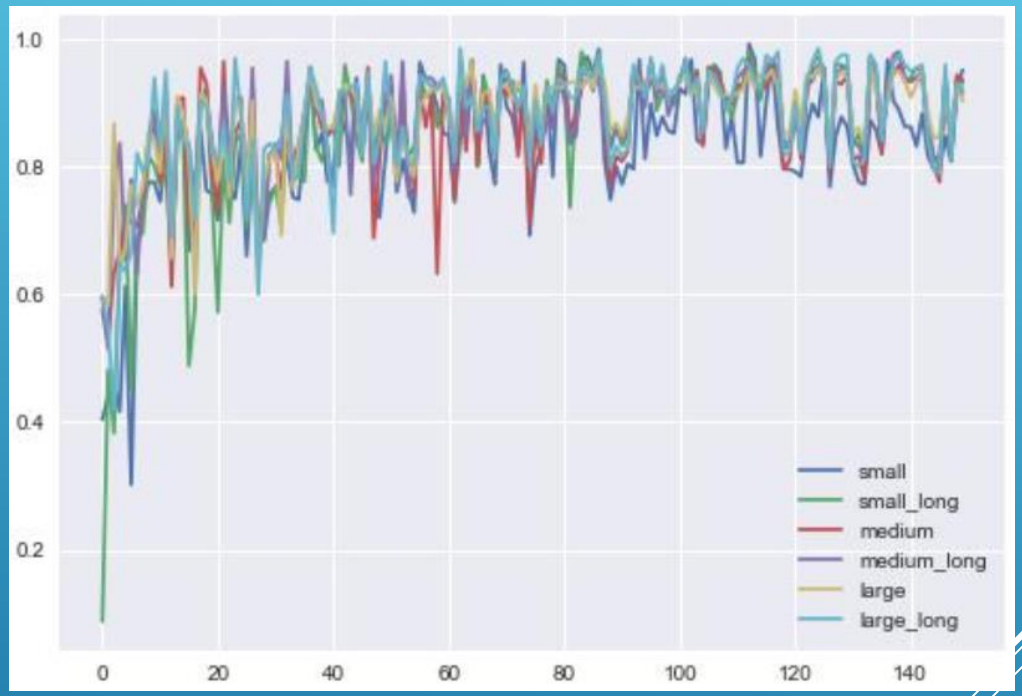
- Top Training Performance – 99%
- Average Converged Performance – 93%

PERFORMANCE COMPARISONS

ORIGINAL MODEL



NEW MODELS



- Graphs display accuracy on test data sample for each epoch of the models
- Models performed comparably

CONVOLUTIONAL NEURAL NETWORK

More advanced connection method between layers

- Uses small filters to take advantage of local similarities
- Treats data as 2D feature space

- Only one small model created – resource limitations
- Trained over 150 iterations

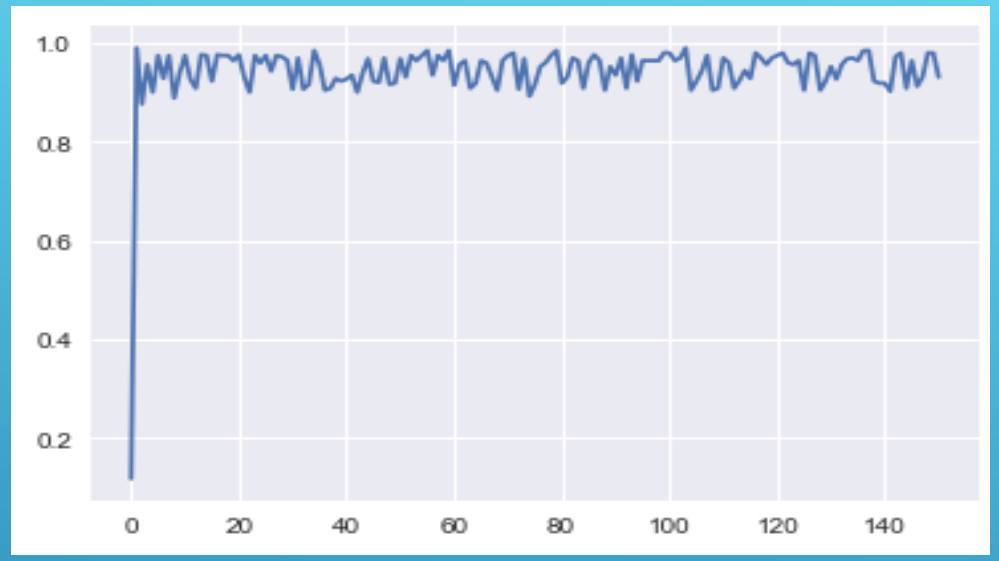
Performance on test data

- Top Training Performance – 99%
- Average Converged Performance – 95%
- Performance over all data with final model – 99%

MODEL EVALUATION

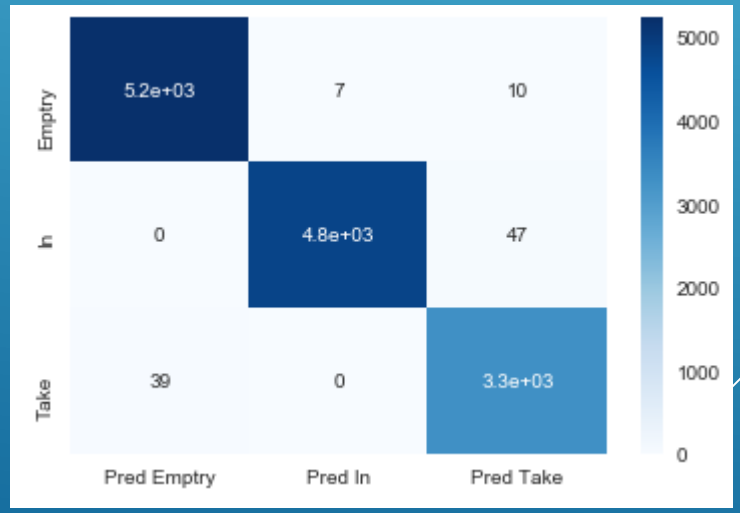
CNN model selected:

- Highest overall performance
- Fastest convergence
- Saved for future use



Confusion Matrix:

- Predicting empty when dog being taken out
- Predicting dog being taken out when in the crate
- Predicting in the crate is most consistent prediction



IMPROVEMENTS

BETTER MODEL

- More data for a more robust system
- Better hardware or online training for a more efficient tuning process

COMPLETE SYSTEM

- Embed model in hardware with camera and online connection
- Add logic to continuously monitor and alert users