

Picture Purrfect

Capture the Best Moment with Your Furry Friend

Katie Huang
March 24th, 2021

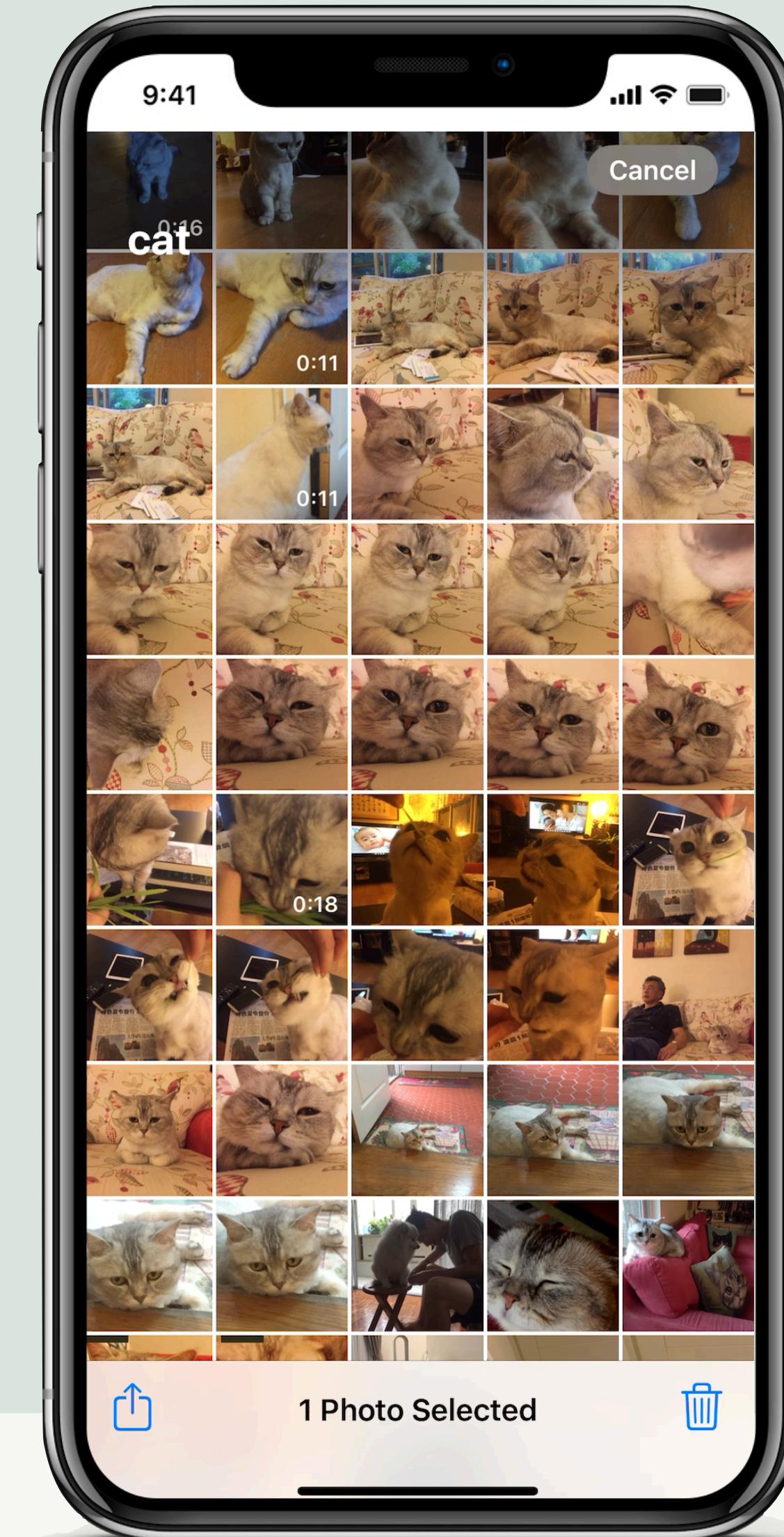
Taking photos for animals...



Taking photos for animals...

Have you ever found yourself...

- Taking a bunch of photos for your furry friend
- Checking each photo
- Manually selecting the bad ones to delete

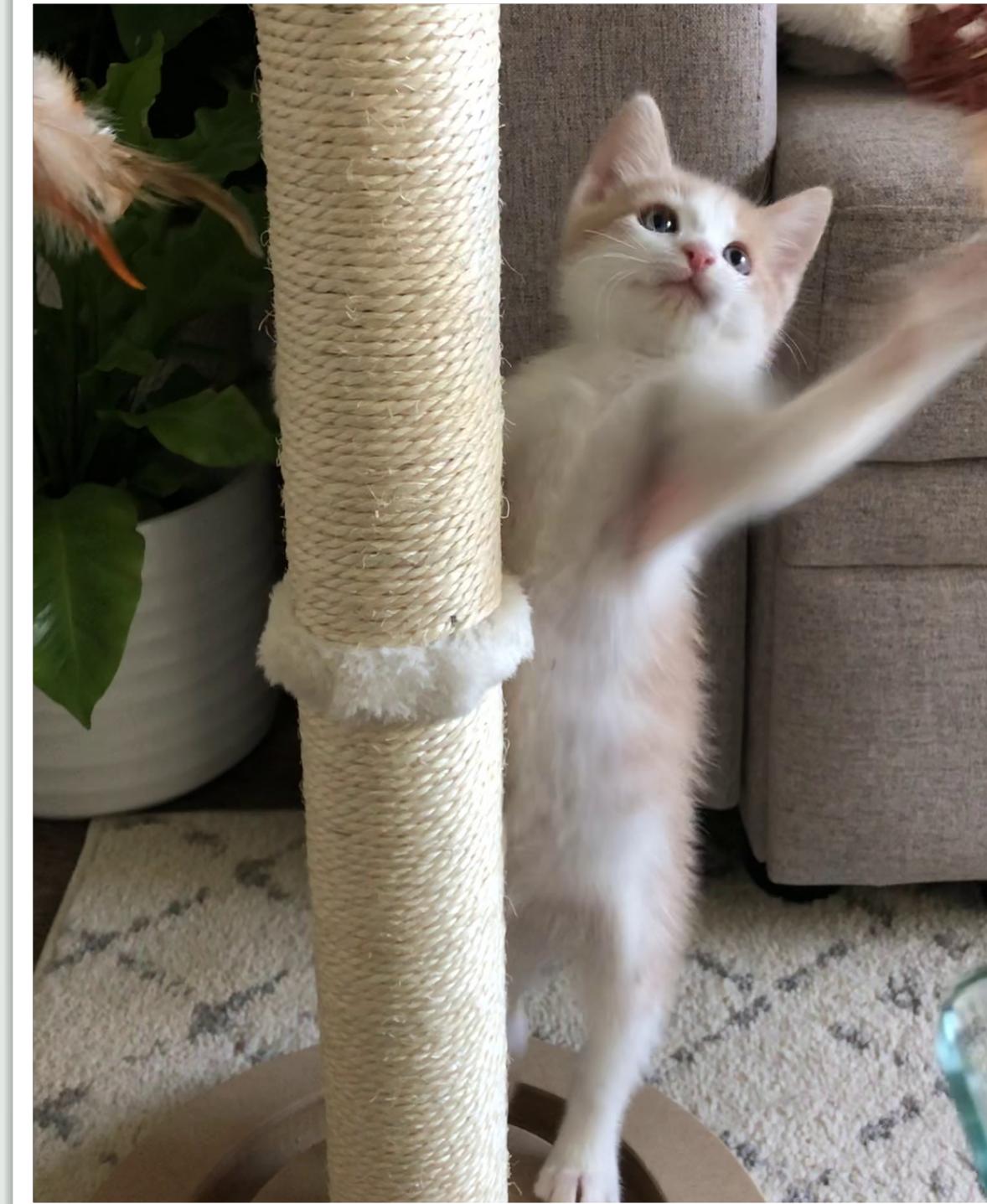


Taking photos for cats...Easy!

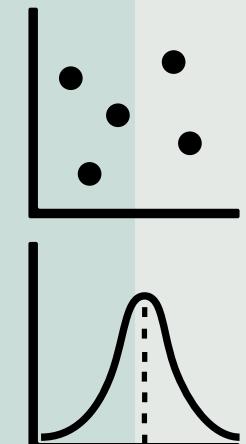
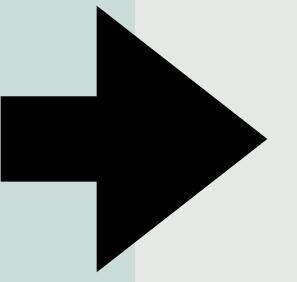
► Short video



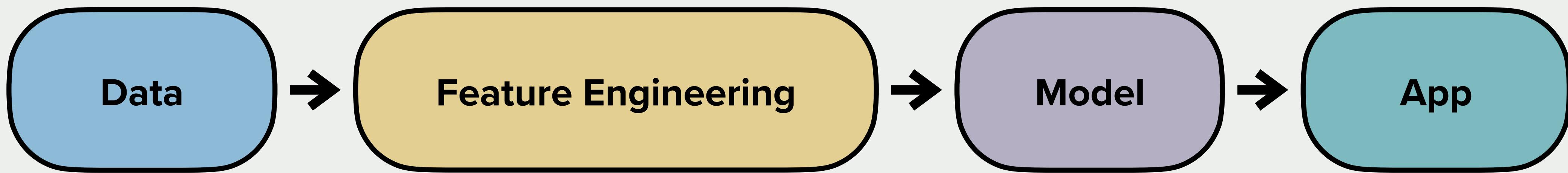
📷 Best frame!



Picture Purrfect
auto-select



Methodology



Data

Feature Engineering

Model

App



- 120 cat videos
- 10-30 seconds
- 2000+ frames

Data

Feature Engineering

Model

App



- 120 cat videos
- 10-30 seconds
- 2000+ frames



Data

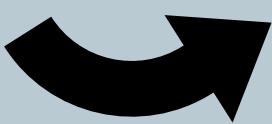
Feature Engineering

Model

App

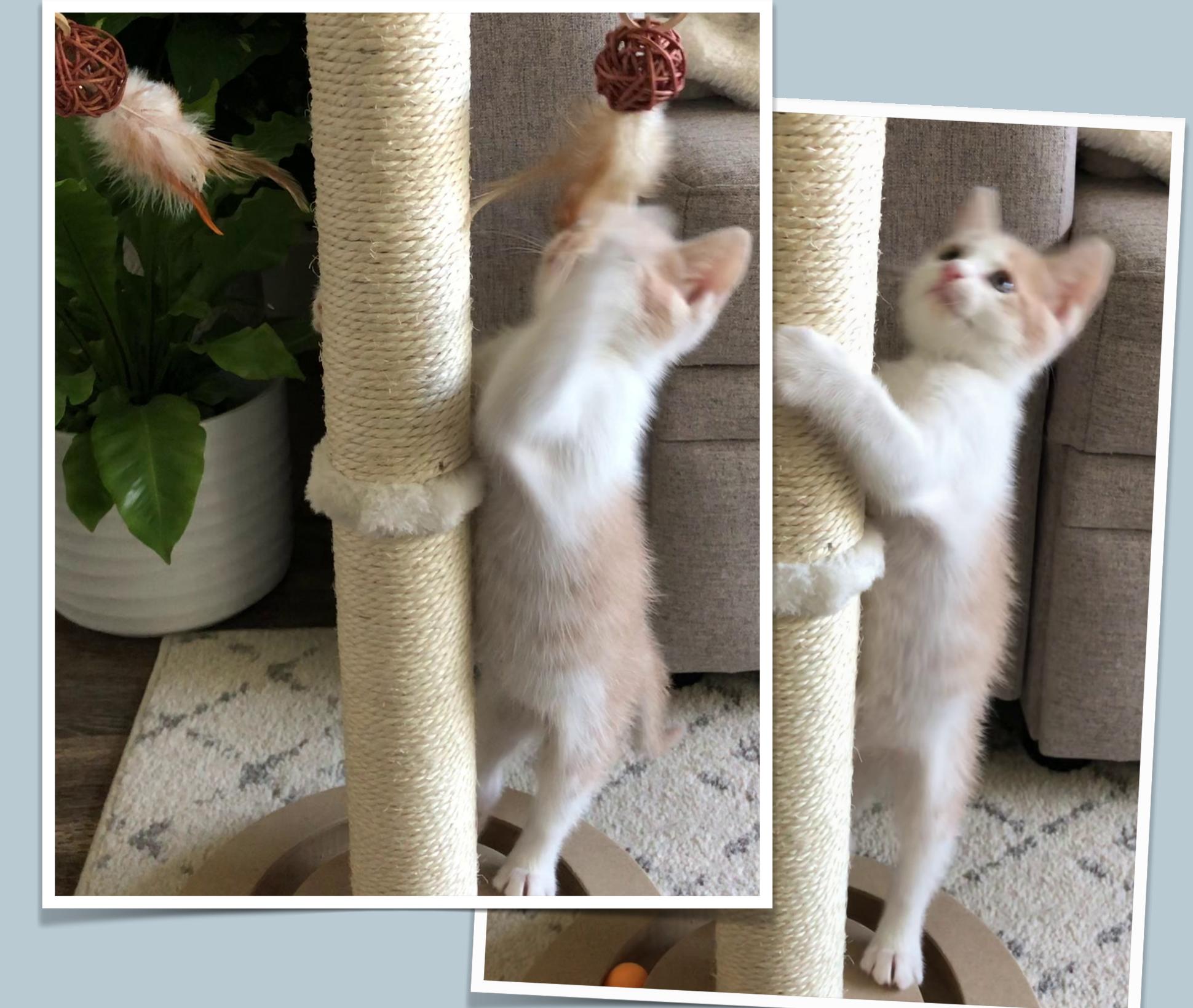


- 120 cat videos
- 10-30 seconds
- 2000+ frames



• Good

- ✓ Cat face shown
- ✓ Cat face clear



• Bad

- ✗ Cat face blocked
- ✗ Cat face blurry

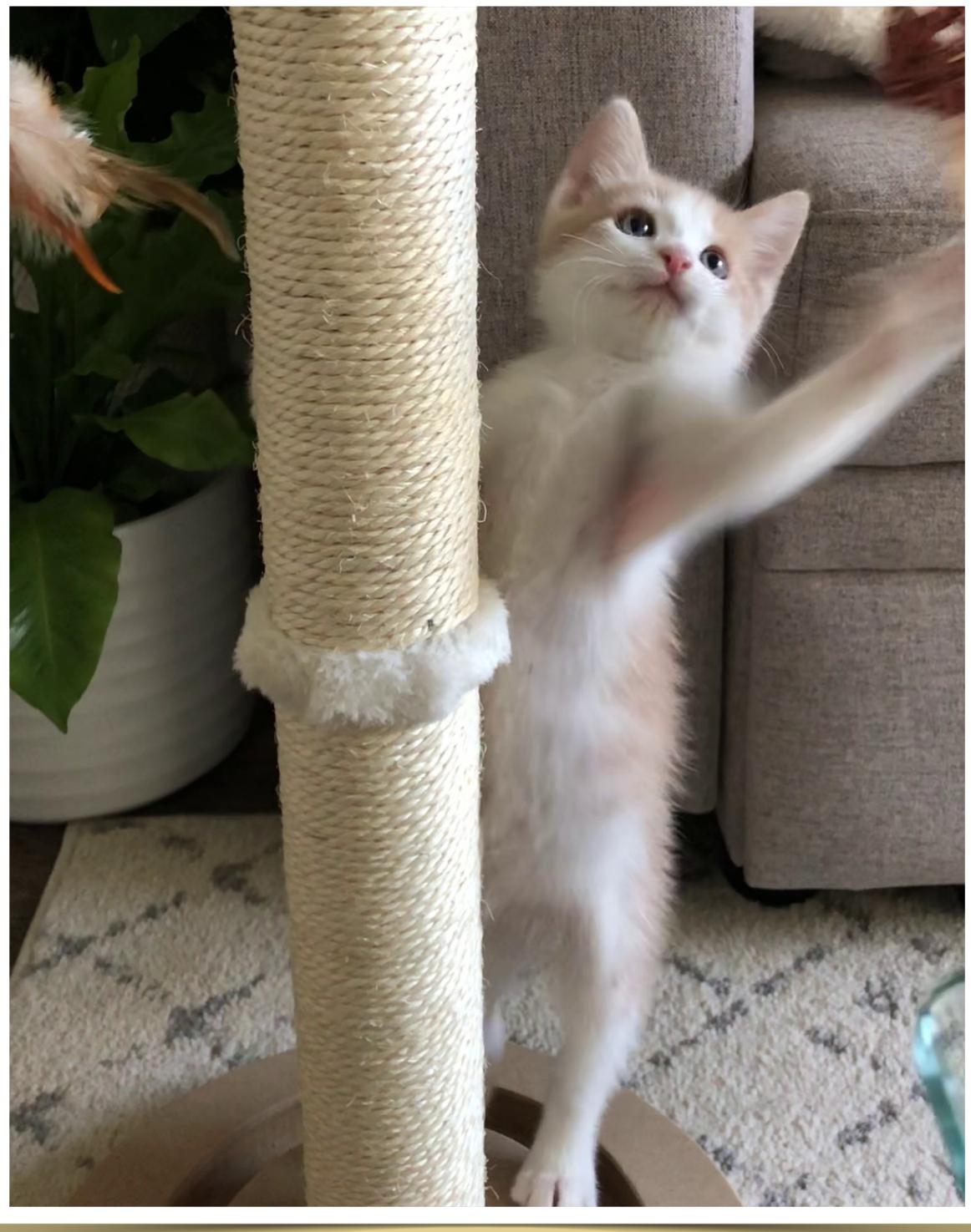
Data

Feature Engineering

Model

App

• Good



*Teach machines how we think?
Features for each frame*

| Feature | Value |
|---------|-------|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

| Feature | Value |
|---------|-------|
| | |
| | |
| | |
| | |
| | |
| | |
| | |

• Bad



Data

Feature Engineering

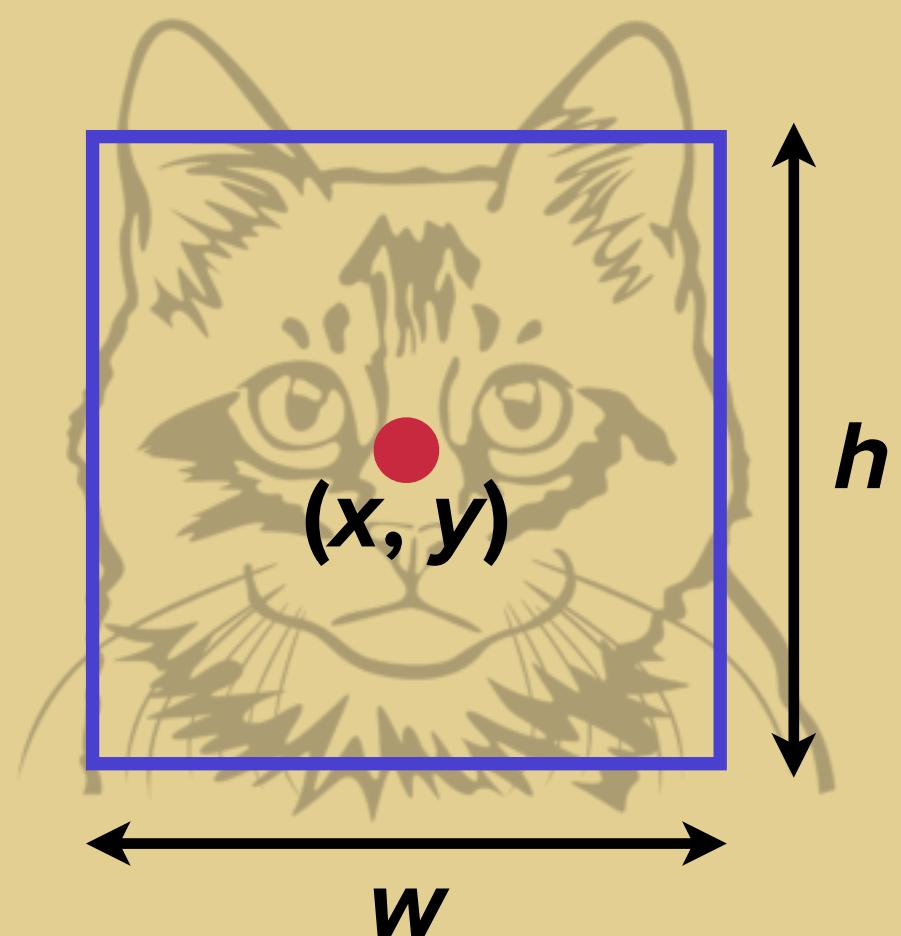
Model

App

1. **Cat face detection**
2. **Blur detection**
3. **Cat facial features detection**

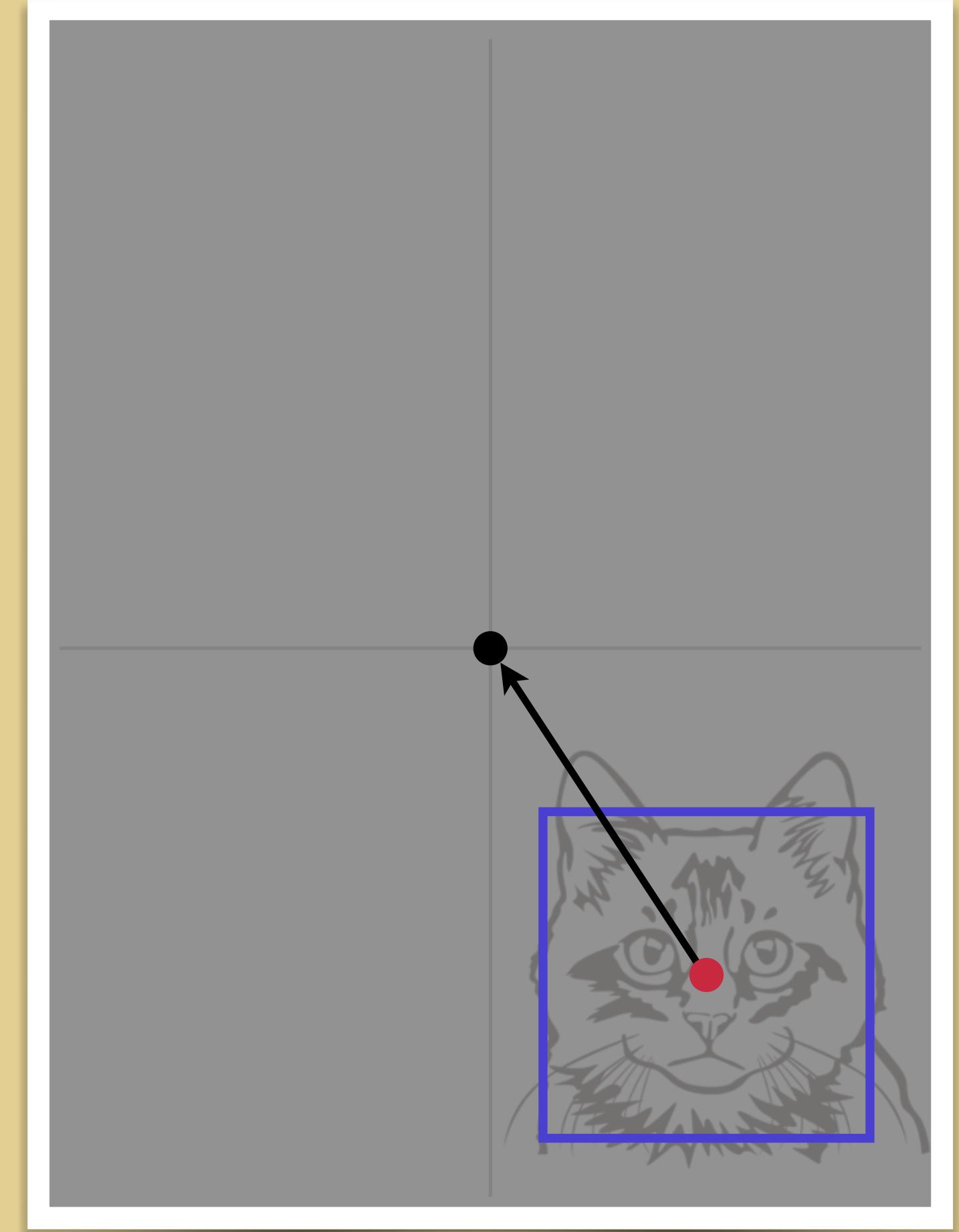
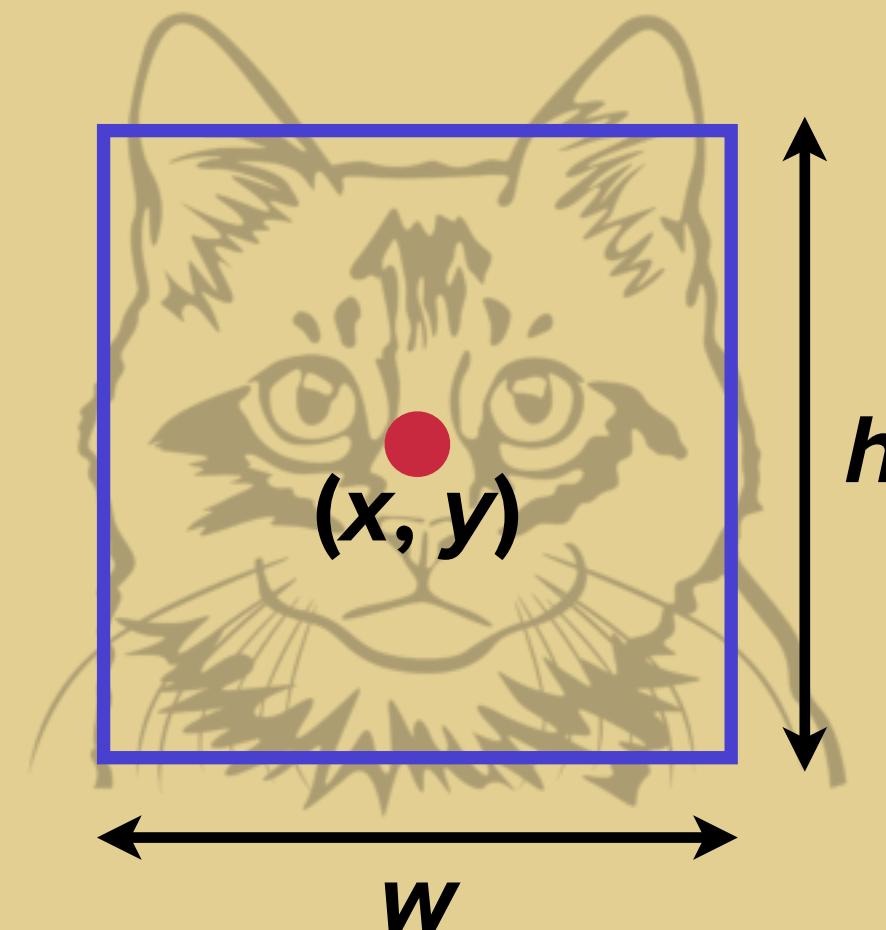
1. Cat face detection

- Haar cascade classifier
 - Cat face position
 - Cat face size



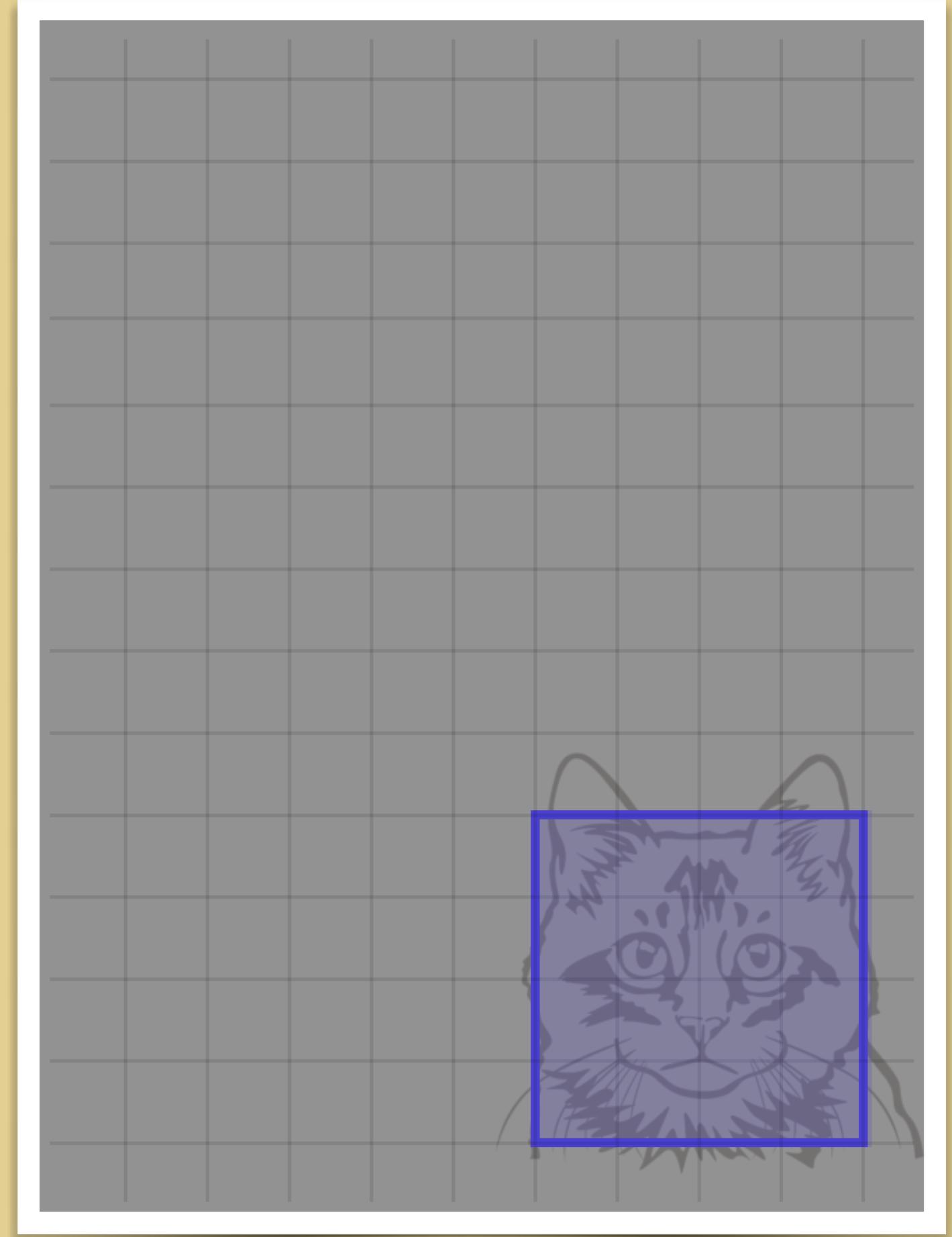
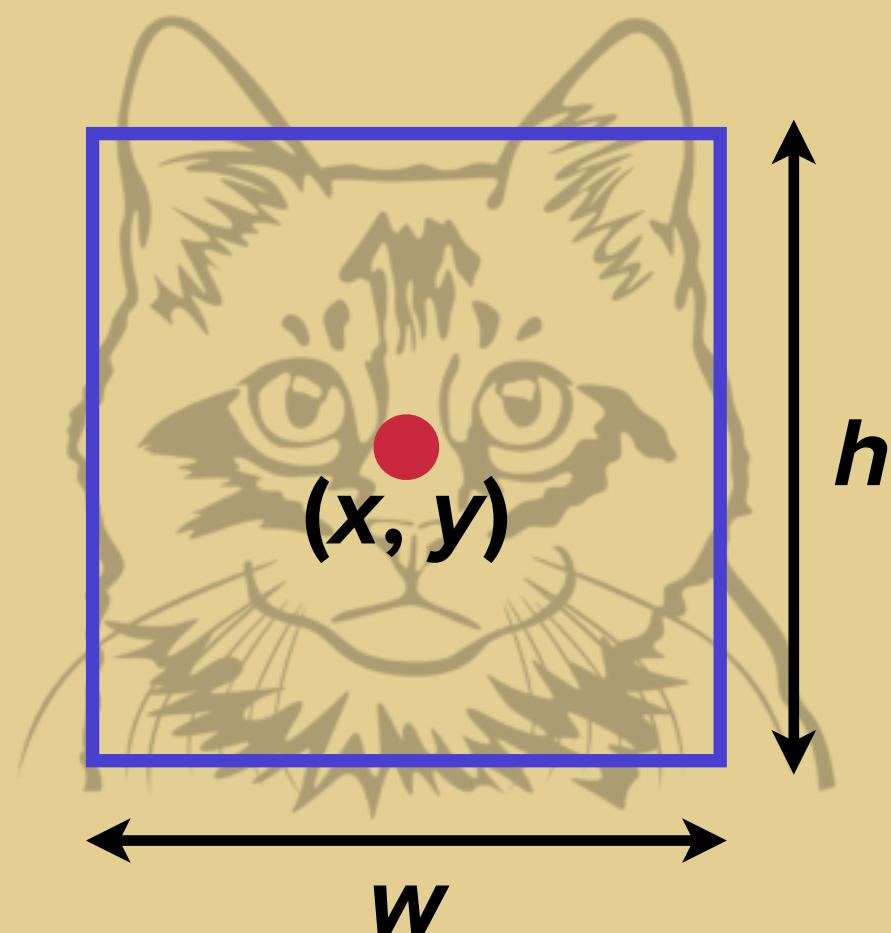
1. Cat face detection

- Haar cascade classifier
 - Cat face position ➡ Distance of face center to frame center
 - Cat face size



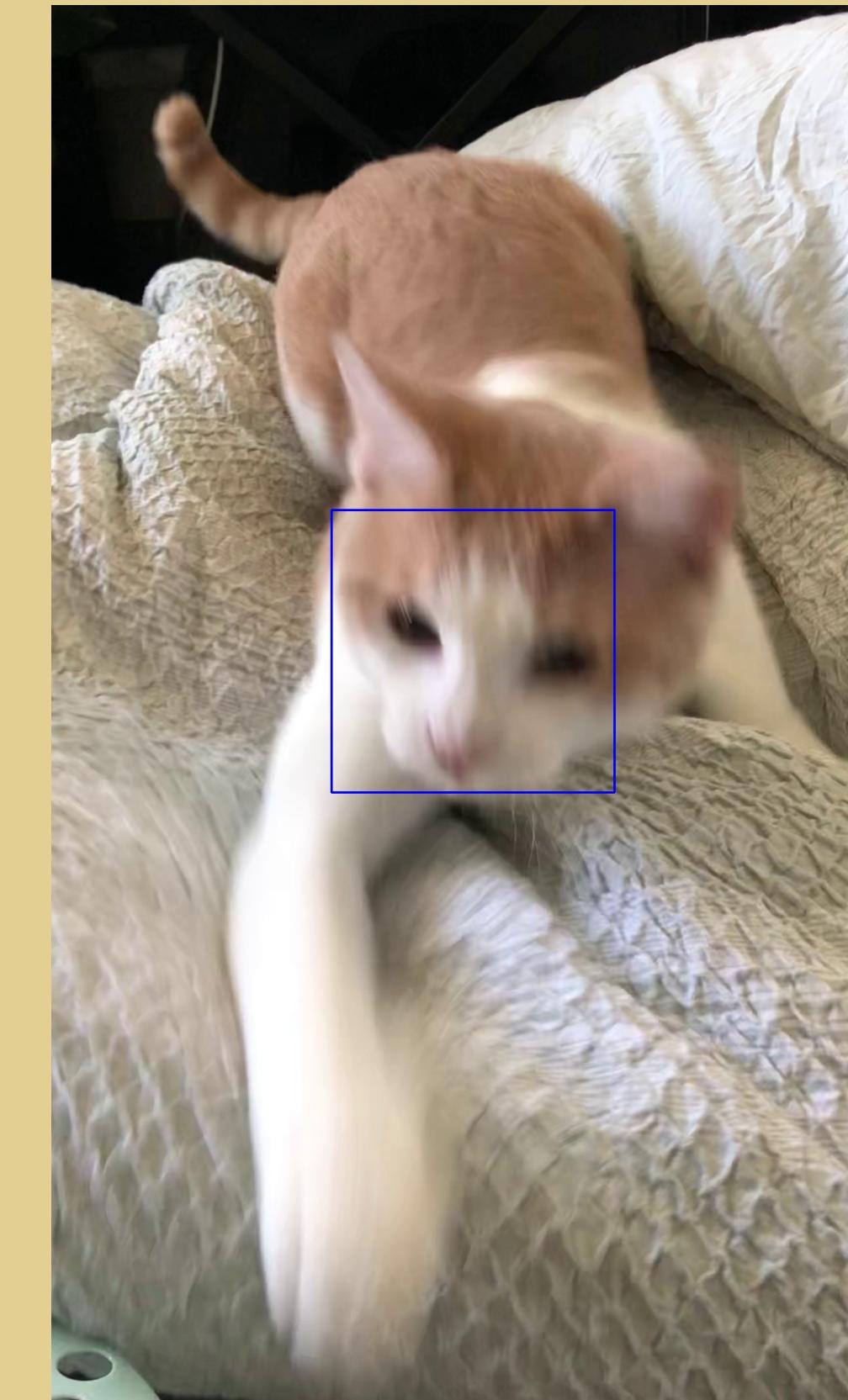
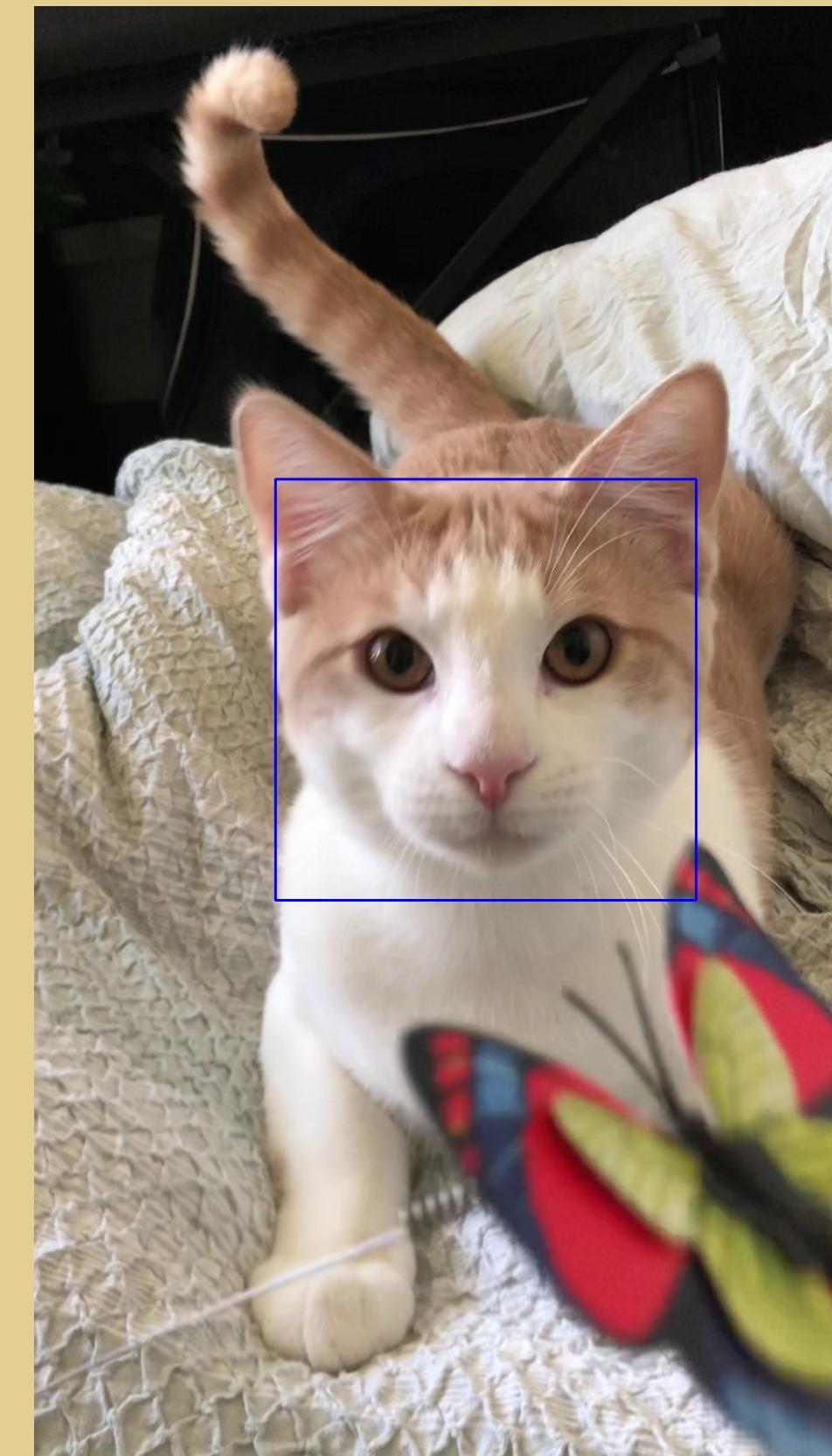
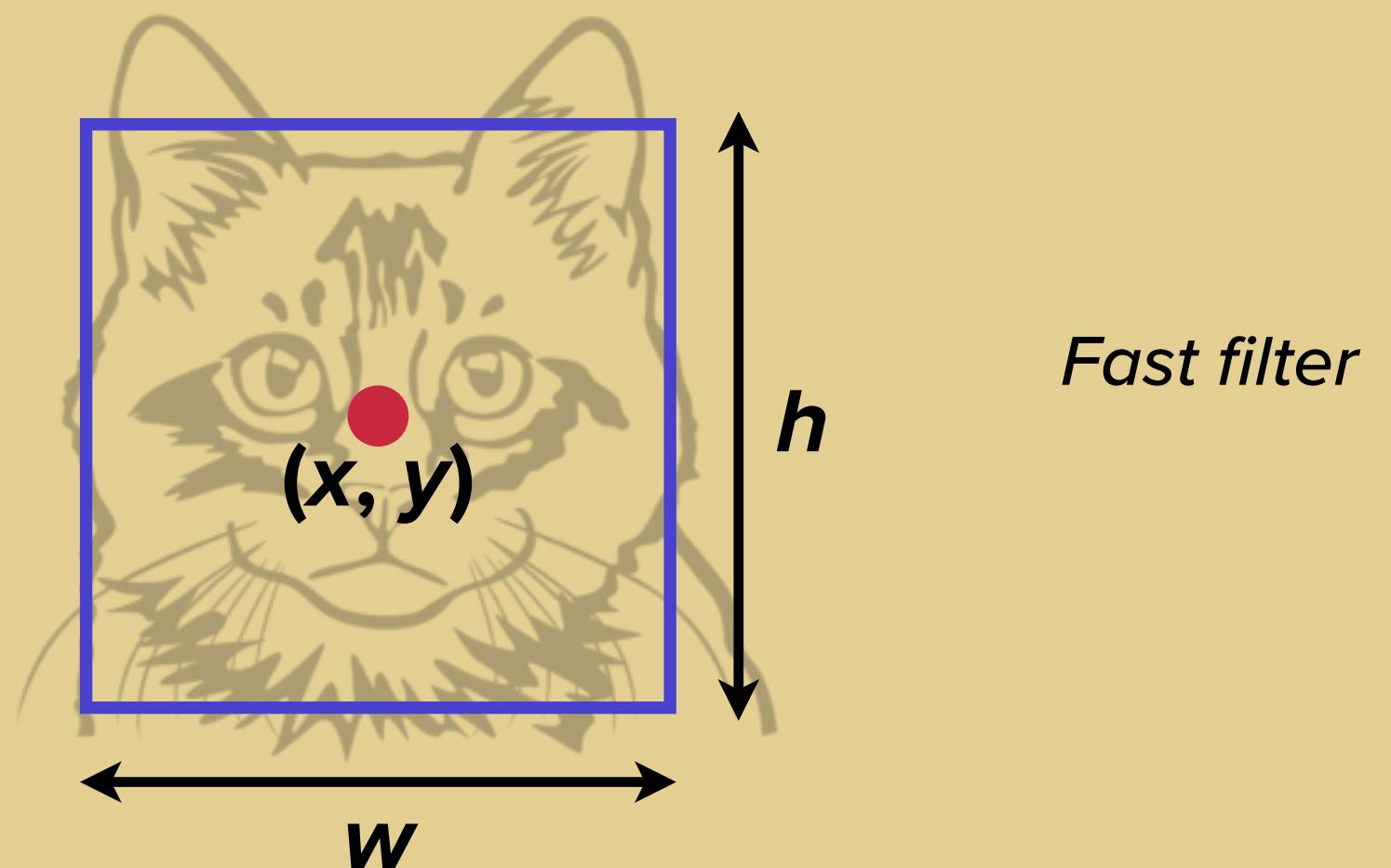
1. Cat face detection

- Haar cascade classifier
 - Cat face position ➤ Distance of face center to frame center
 - Cat face size ➤ Size ratio (face : whole)



1. Cat face detection

- Haar cascade classifier
 - Cat face position ➤ Distance to frame center
 - Cat face size ➤ Size ratio (face : whole)



Data

Feature Engineering

Model

App

2. Blur detection



Original

Data

Feature Engineering

Model

App

2. Blur detection

- Algorithm
 - Laplacian
 - Canny edge

Cat face not blurry



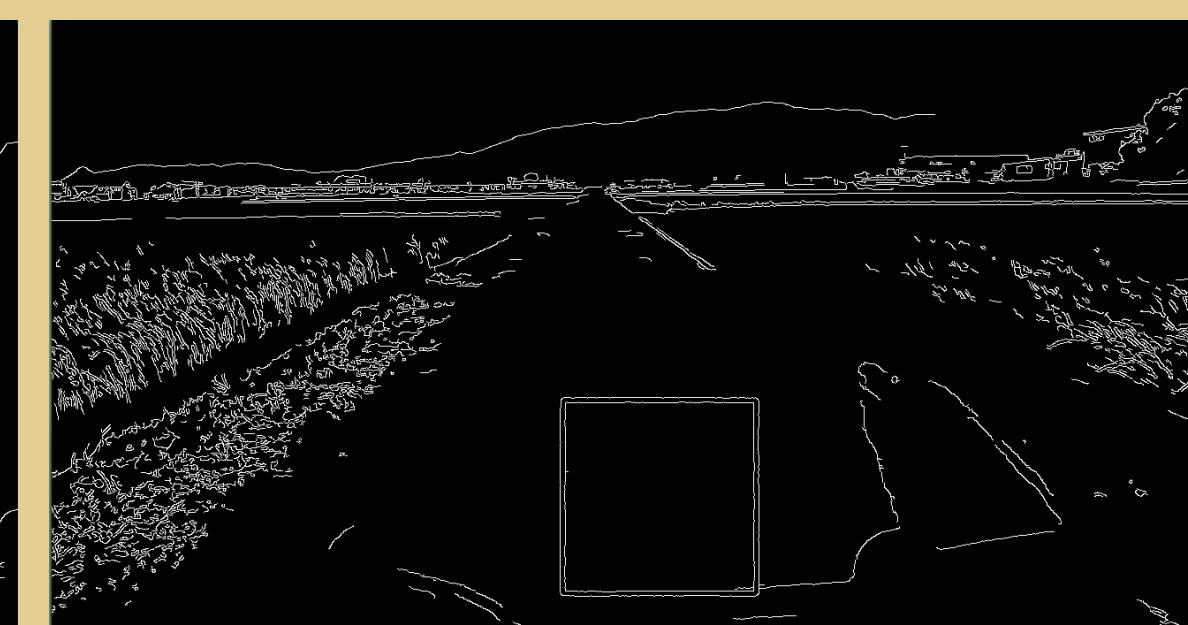
Cat face blurry



Original



Laplacian



Canny

Data

Feature Engineering

Model

App

2. Blur detection

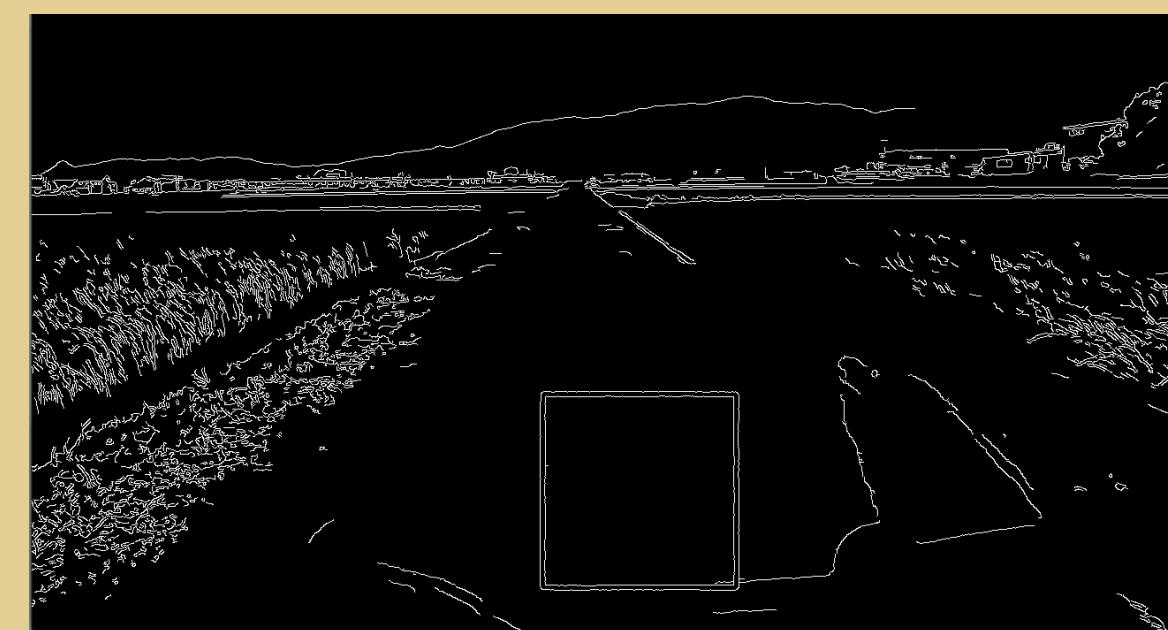
- Algorithm
 - Laplacian
 - Canny edge
- Region



Original



Laplacian



Canny

Data

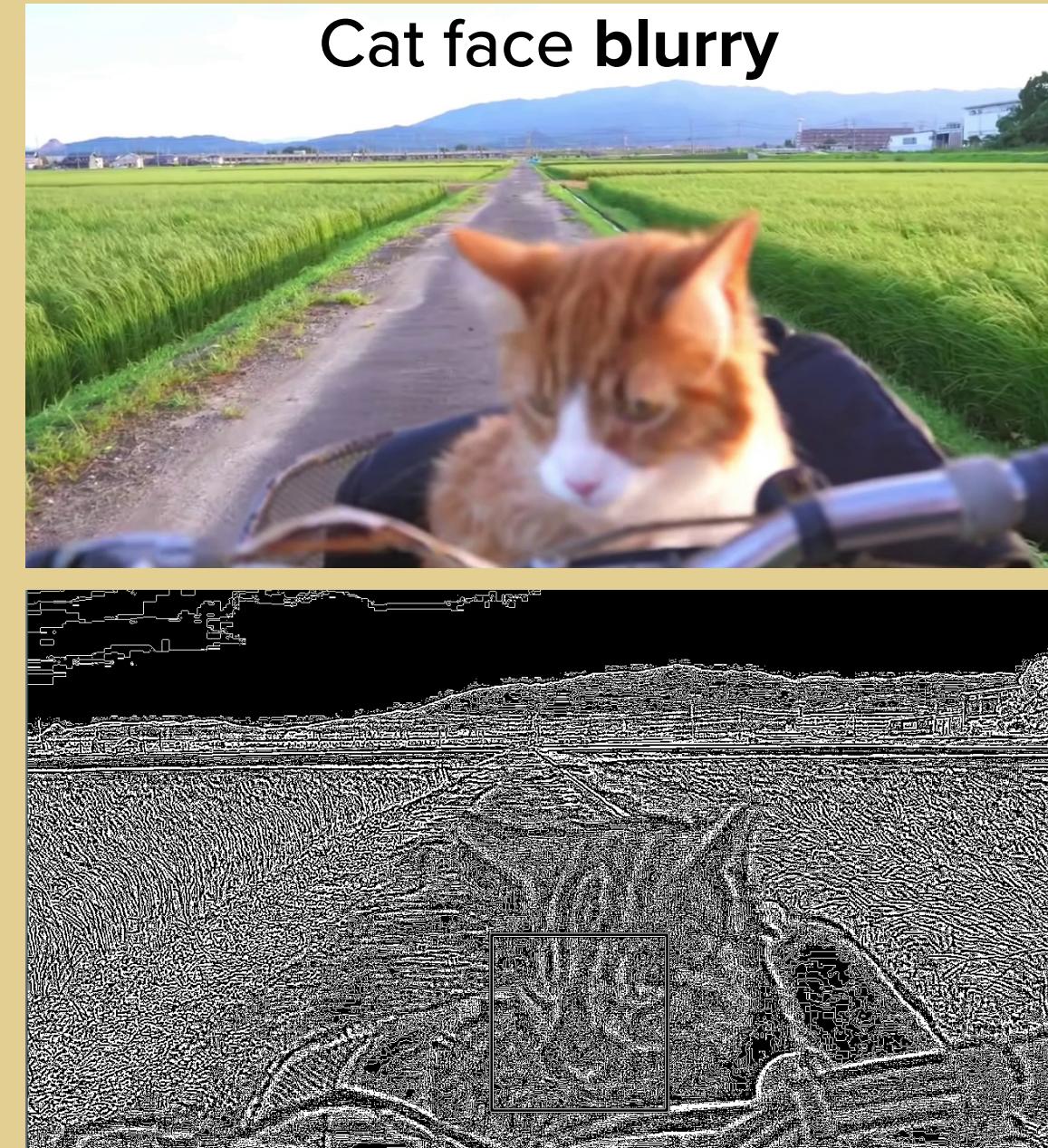
Feature Engineering

Model

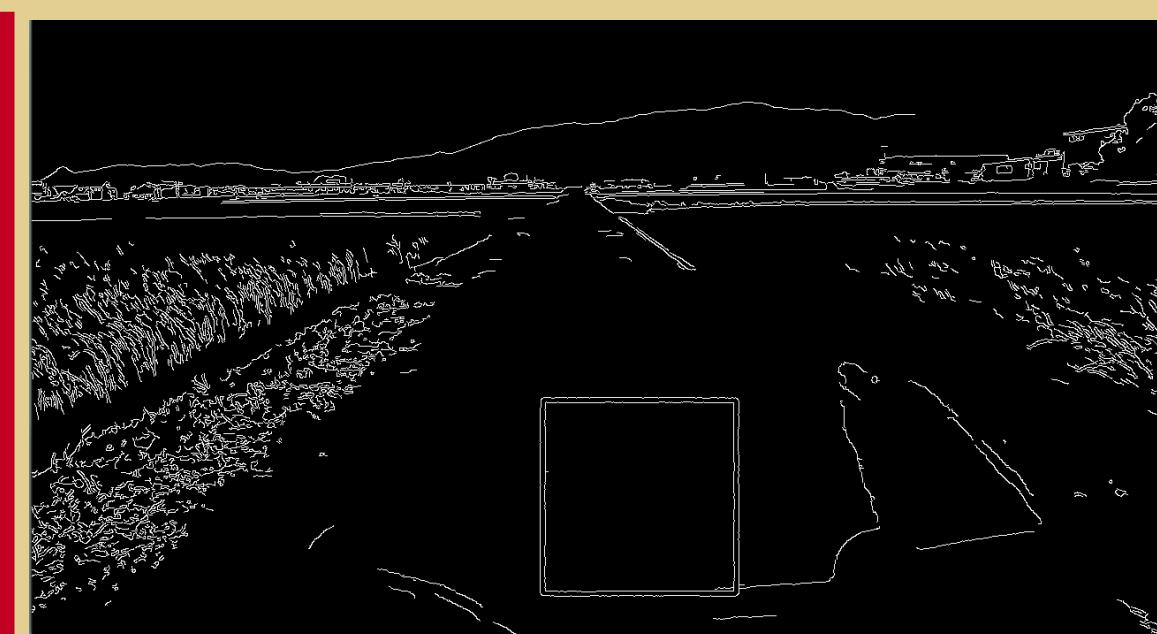
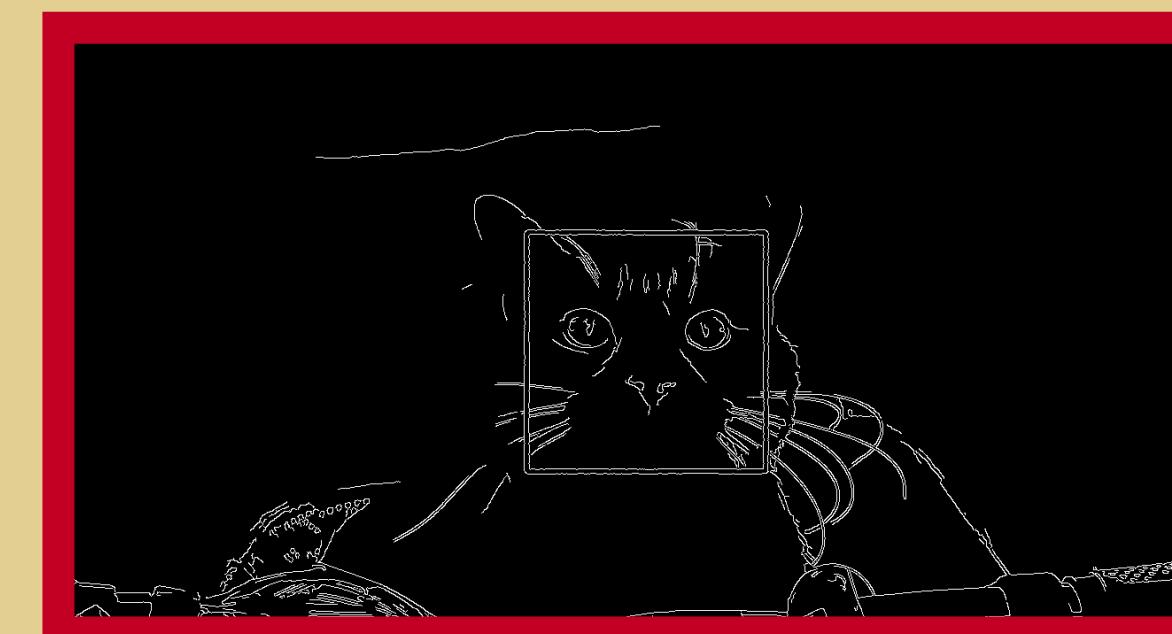
App

2. Blur detection

- Algorithm
 - Laplacian
 - Canny edge
- Region
 - Whole frame



Original



Laplacian

Canny

Data

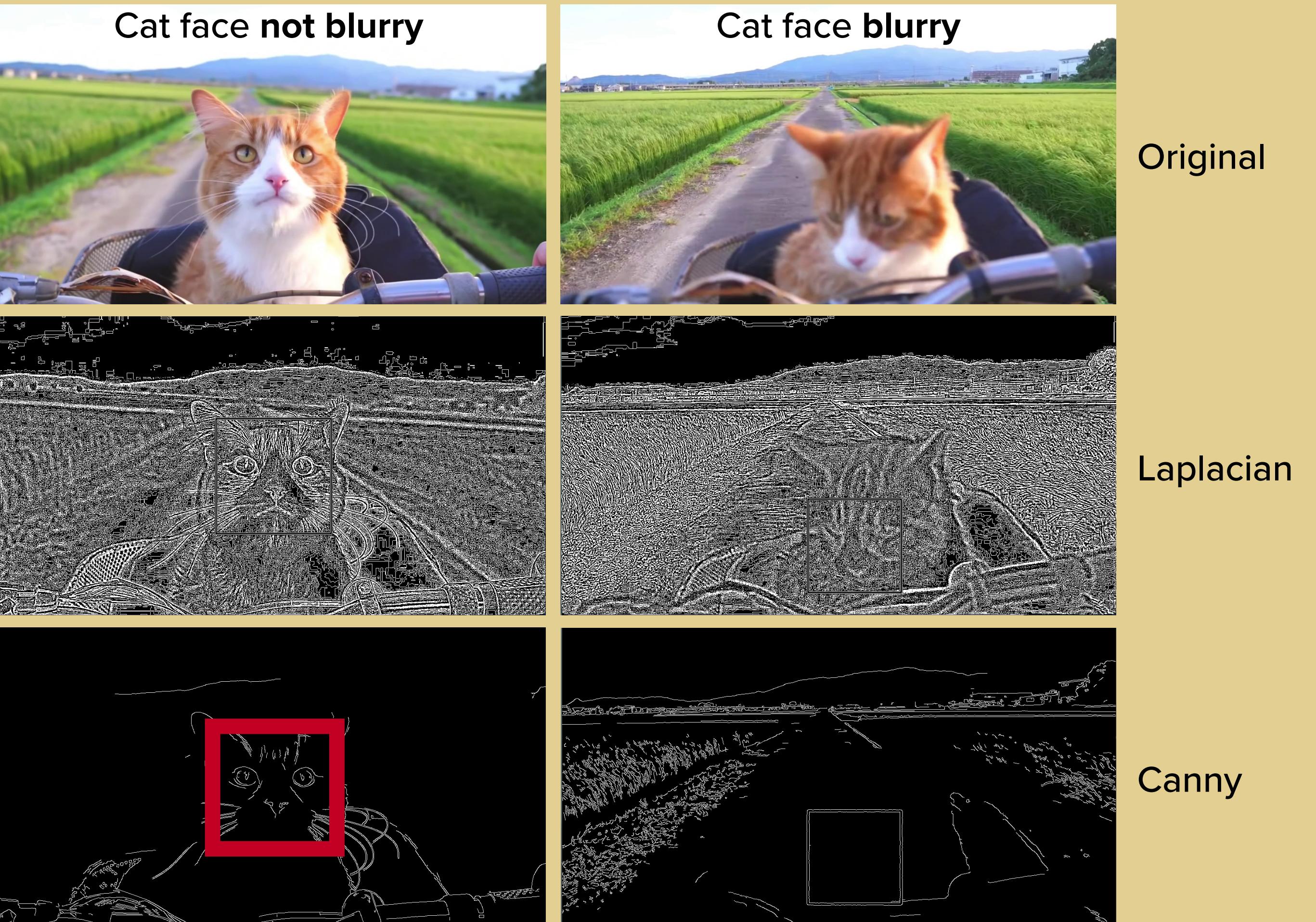
Feature Engineering

Model

App

2. Blur detection

- Algorithm
 - Laplacian
 - Canny edge
- Region
 - Whole frame
 - Cat face



Data

Feature Engineering

Model

App

2. Blur detection

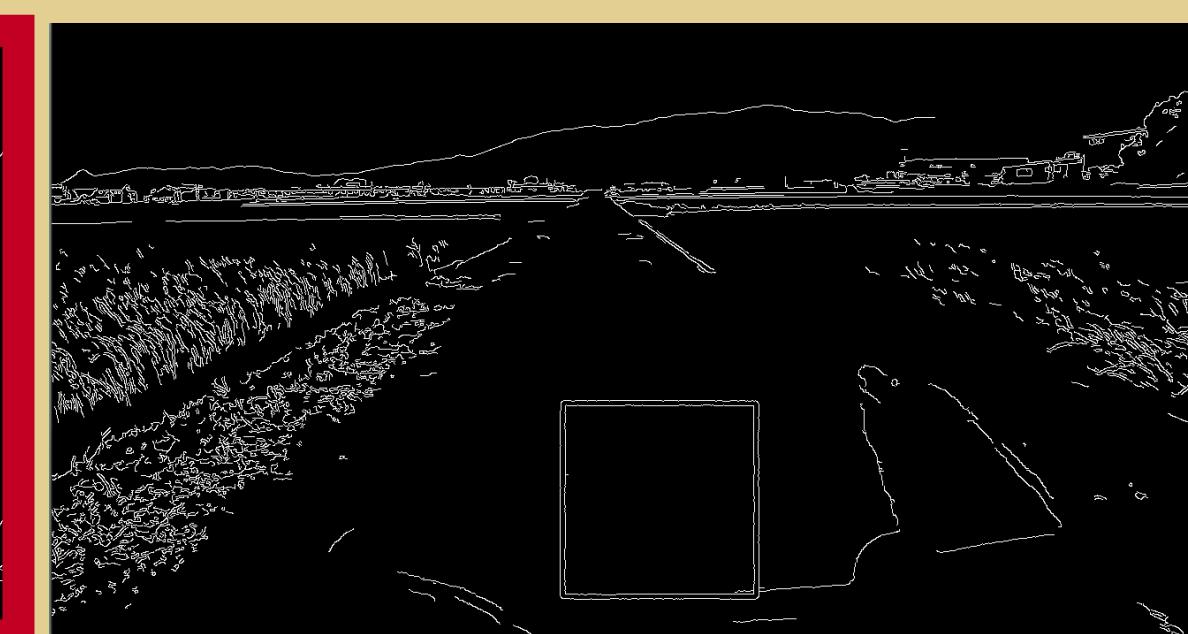
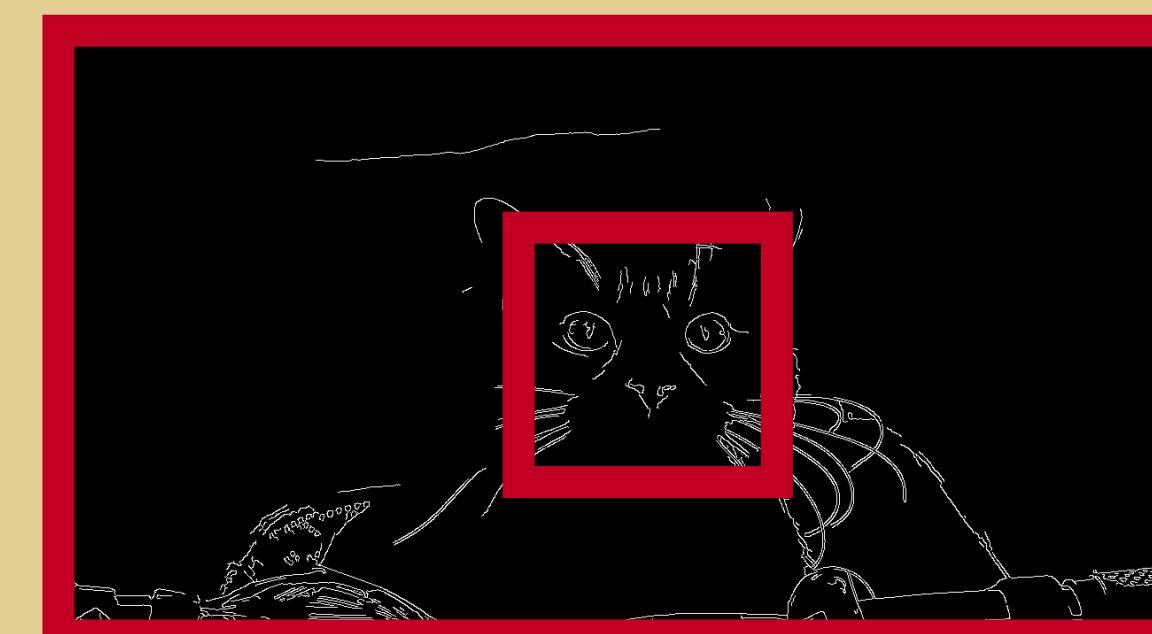
- **Algorithm**
 - Laplacian
 - Canny edge
- **Region**
 - Whole frame
 - Cat face
 - Sharpness ratio (face : whole)



Original



Laplacian



Canny

Data

Feature Engineering

Model

App

3. Cat facial features detection

- **Custom trained object detector**
Neural network (darknet)



Data

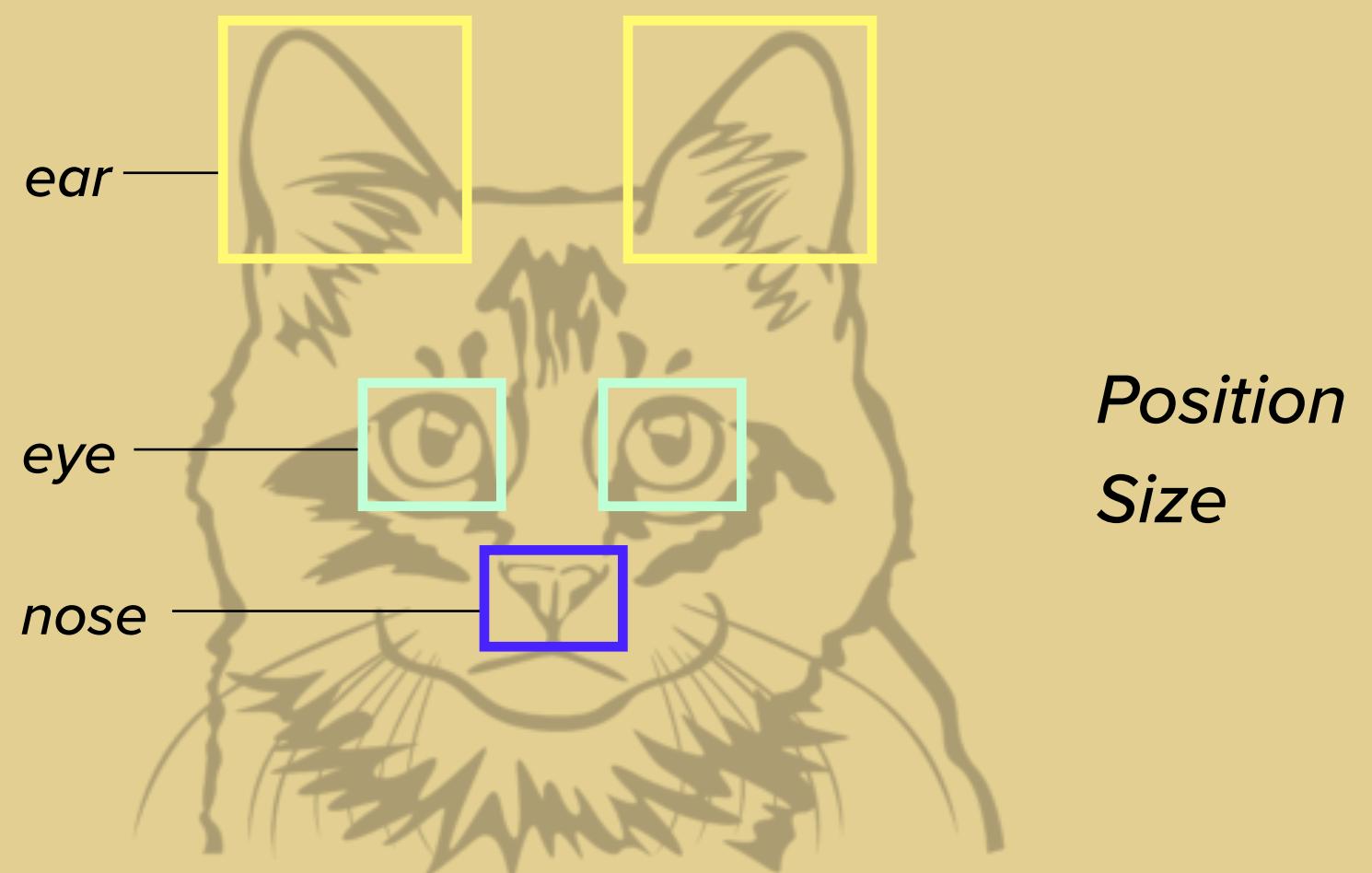
Feature Engineering

Model

App

3. Cat facial features detection

- Custom trained object detector
Neural network (darknet)



Data

Feature Engineering

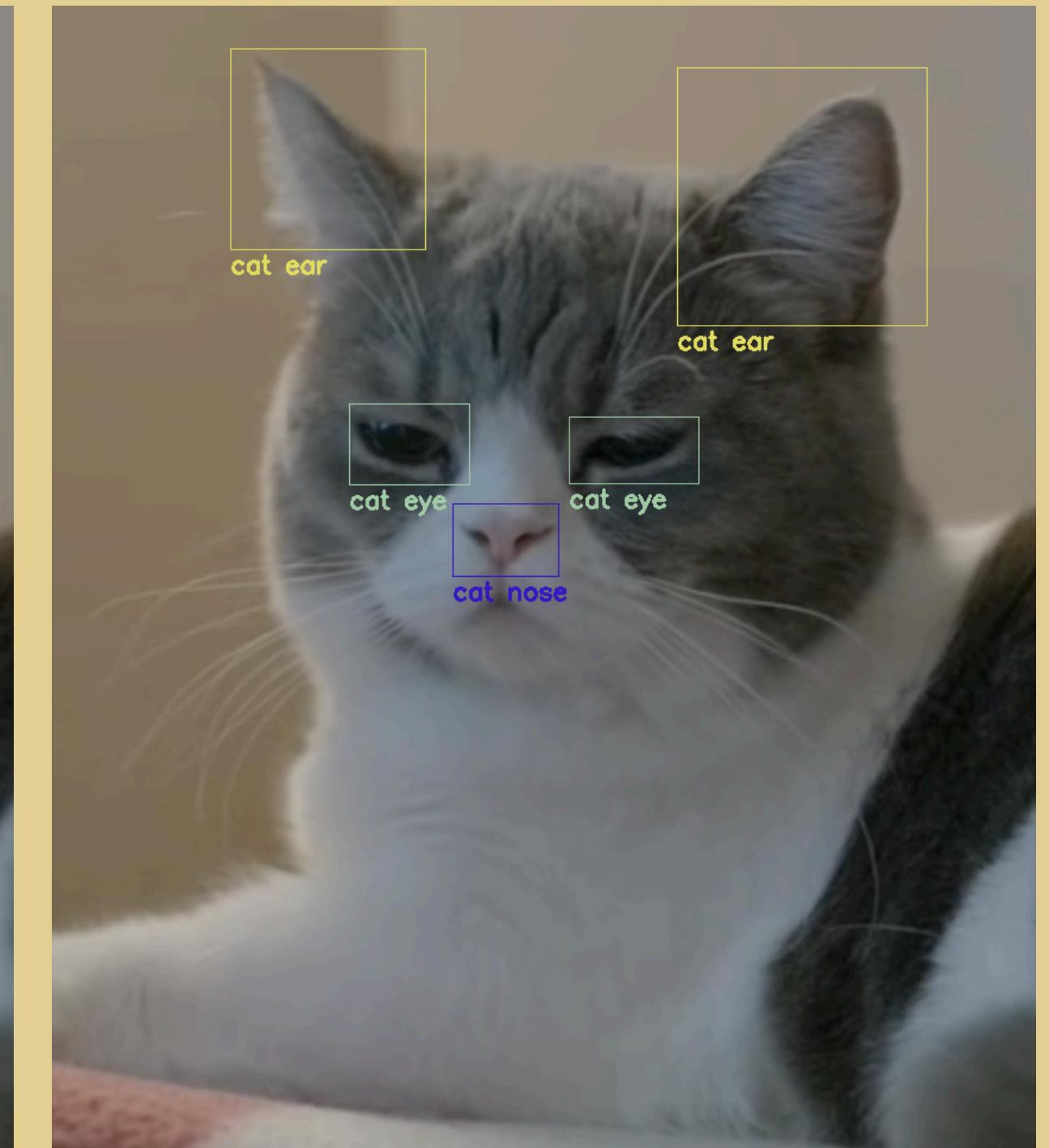
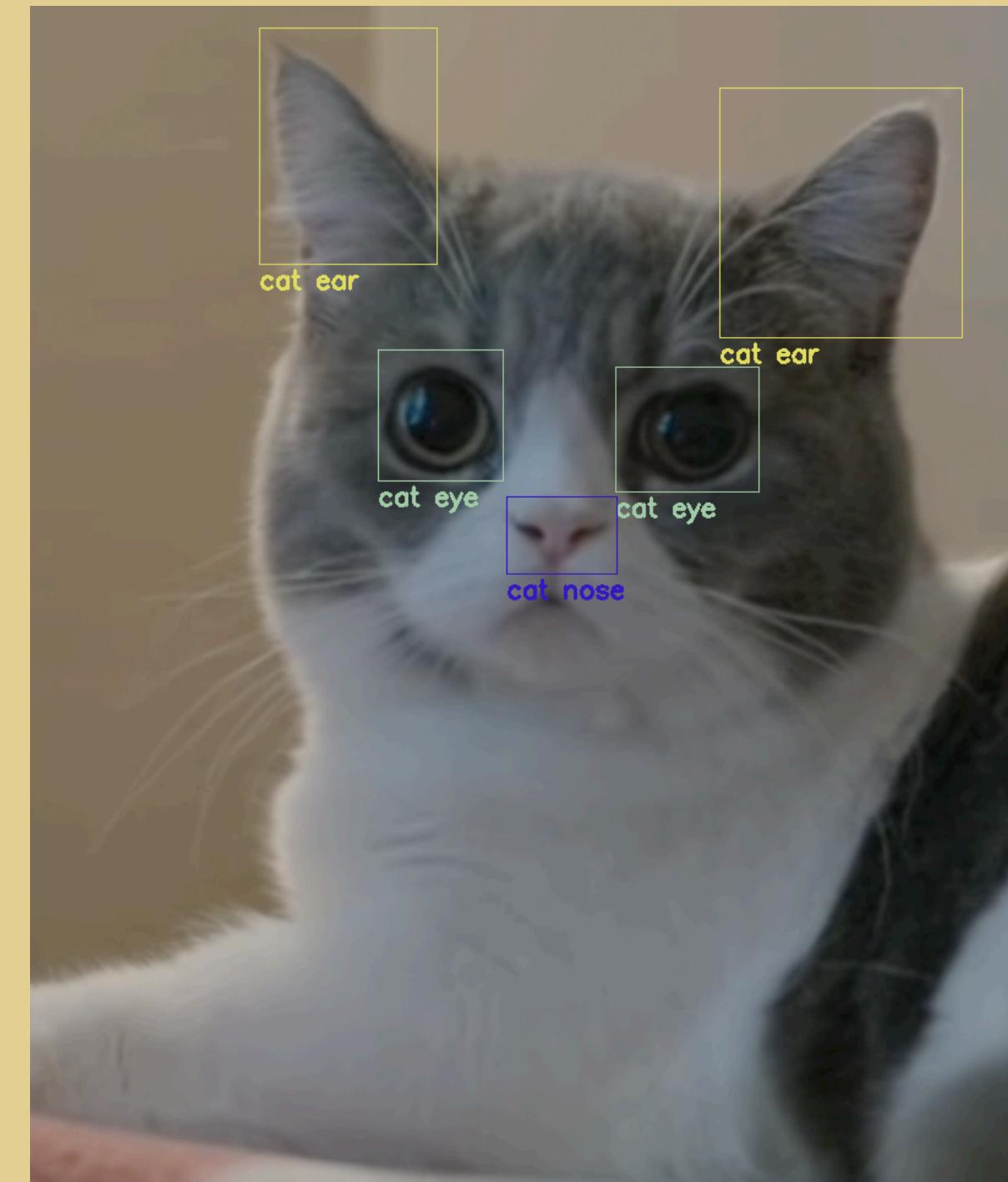
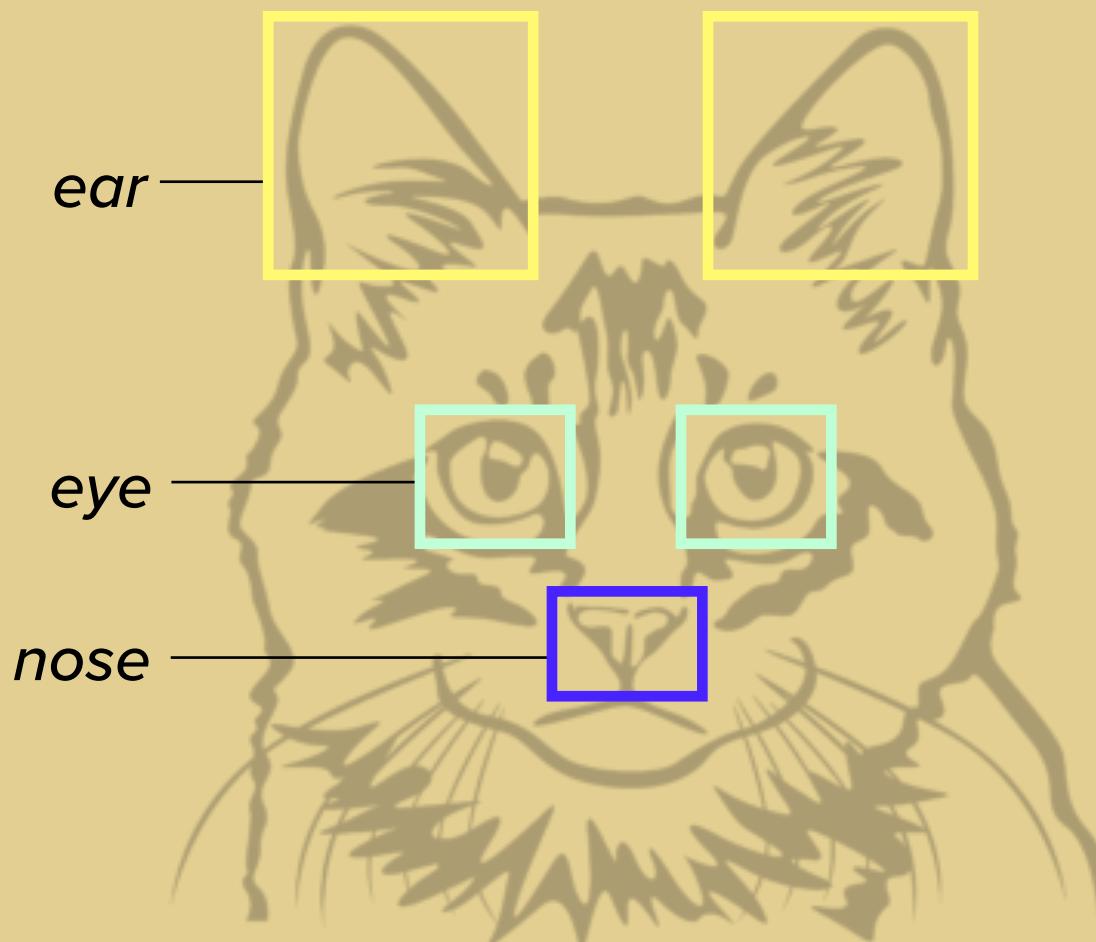
Model

App

3. Cat facial features detection

- Custom trained object detector

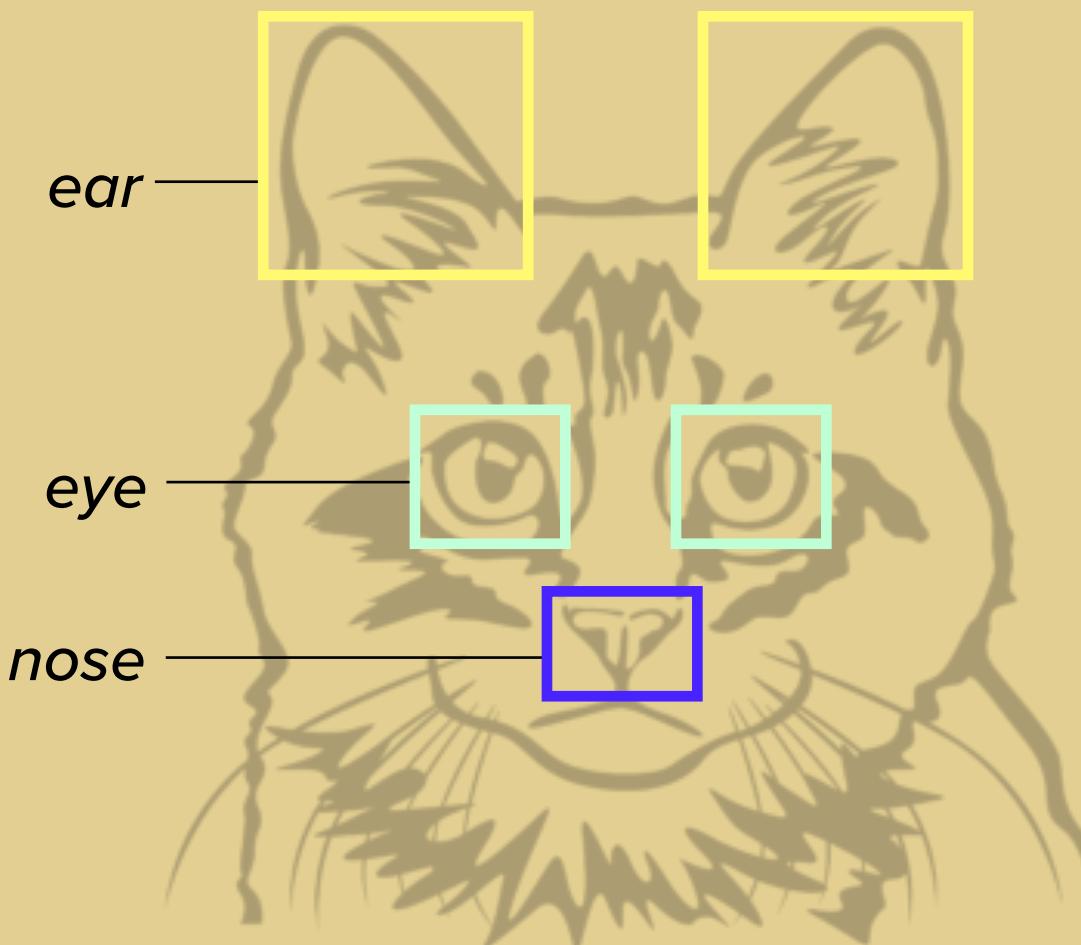
Neural network (darknet)



3. Cat facial features detection

- Custom trained object detector

Neural network (darknet)



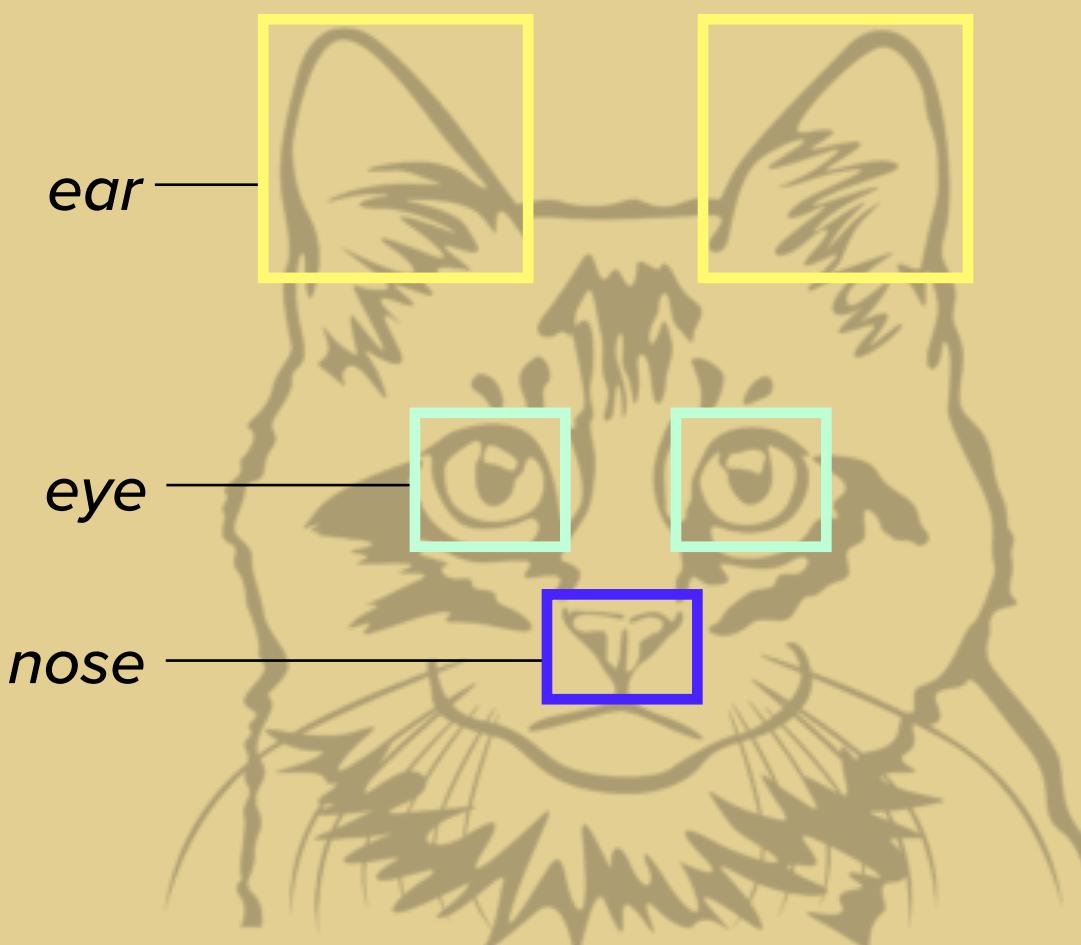
- Eye height
- Eye width



3. Cat facial features detection

- Custom trained object detector

Neural network (darknet)



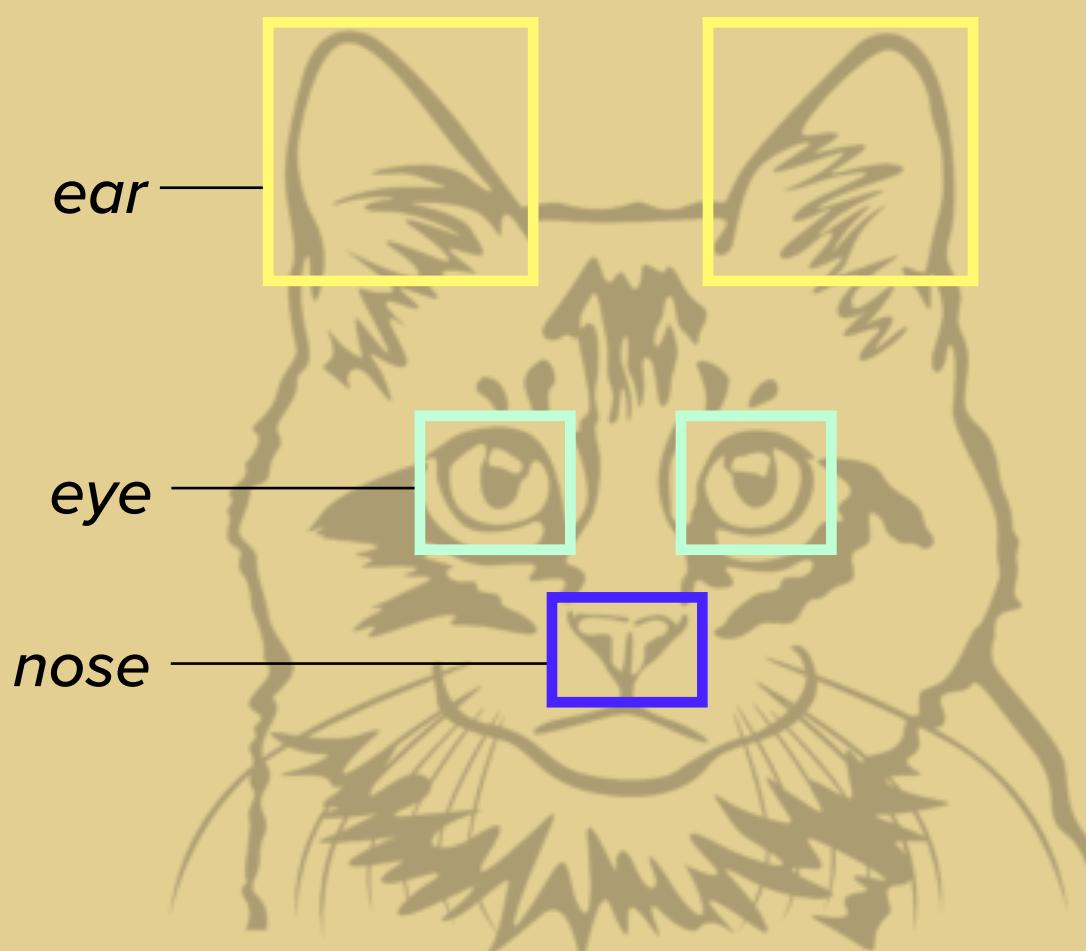
- Eye height
- Eye width
- ▷ Eye shape (h:w)



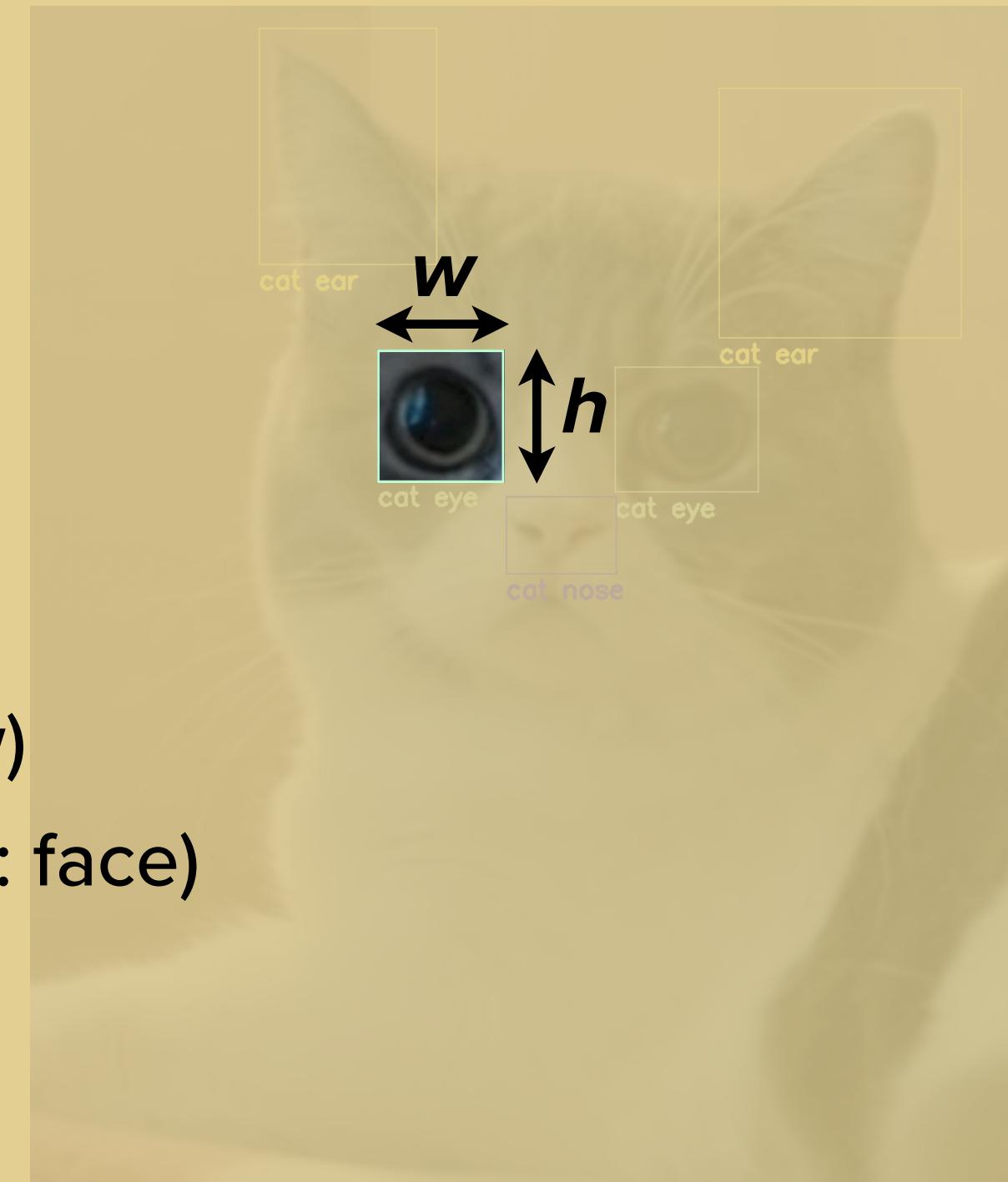
3. Cat facial features detection

- **Custom trained object detector**

Neural network (darknet)



- Eye height
- Eye width
- Eye shape ($h:w$)
- Size ratio (eye : face)



Data

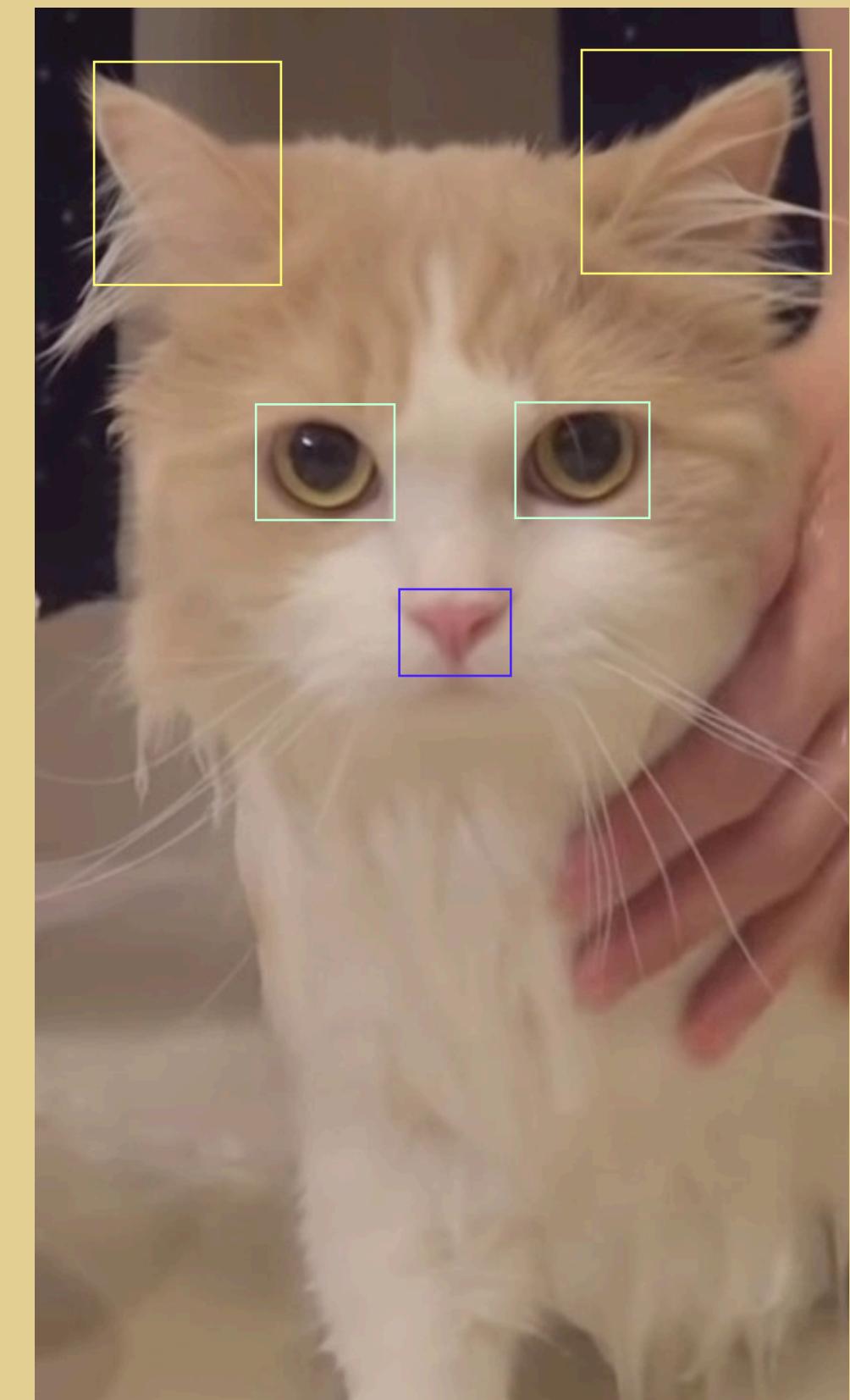
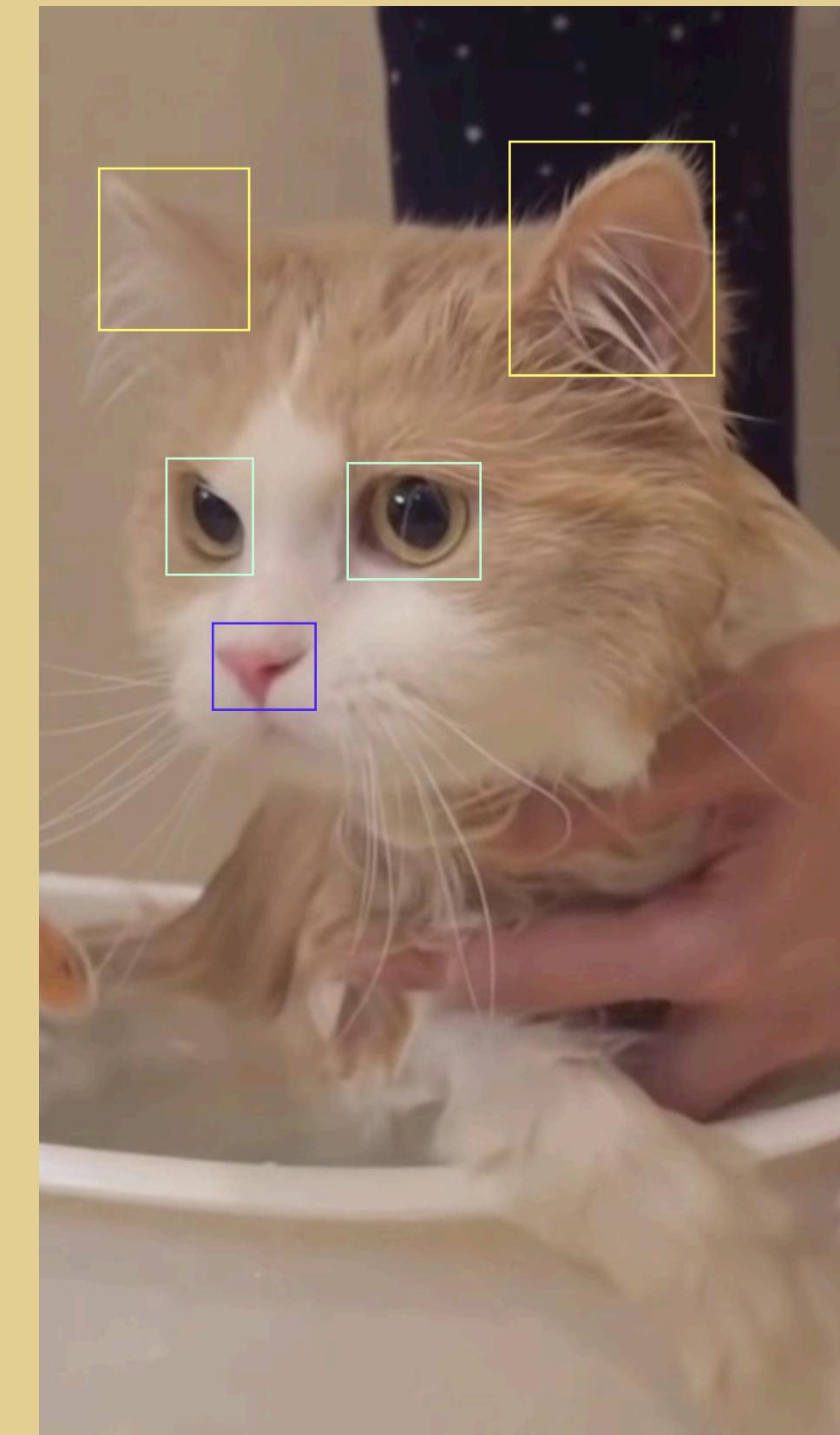
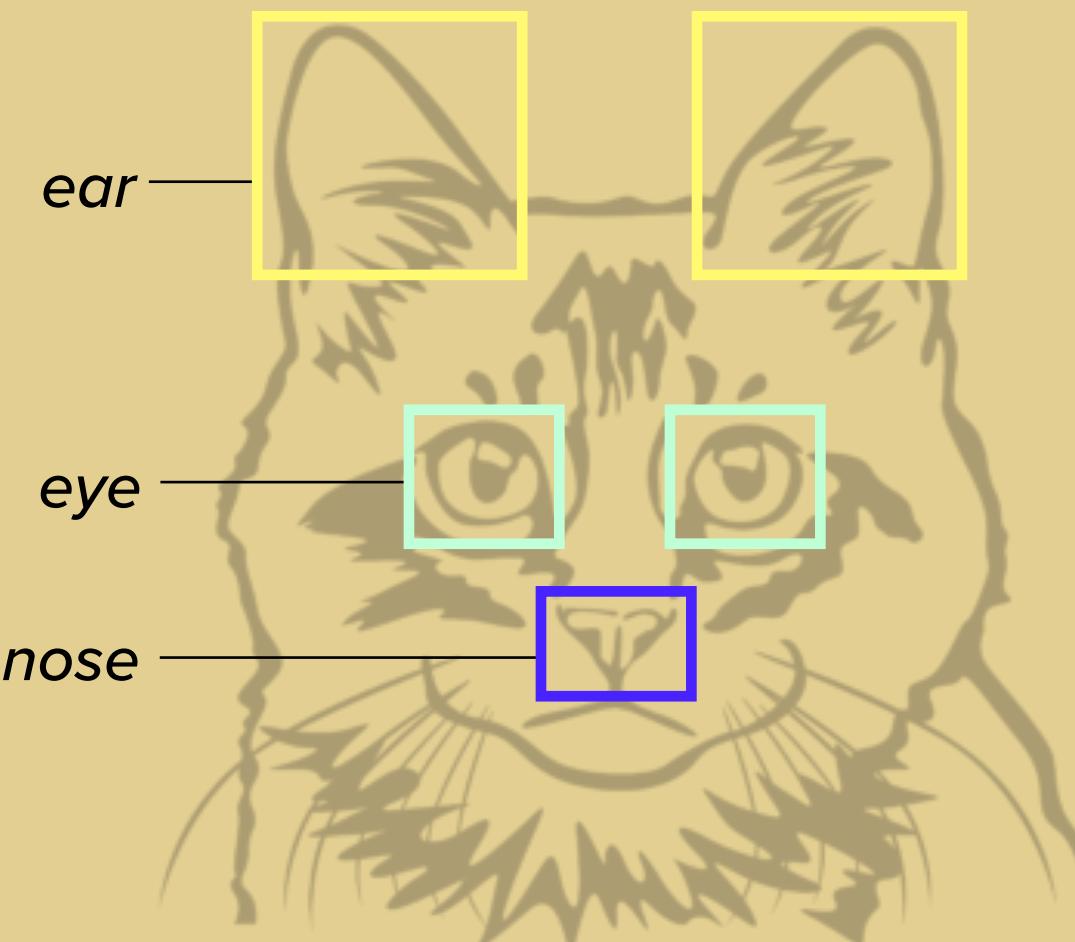
Feature Engineering

Model

App

3. Cat facial features detection

- **Custom trained object detector**
Neural network (darknet)



Data

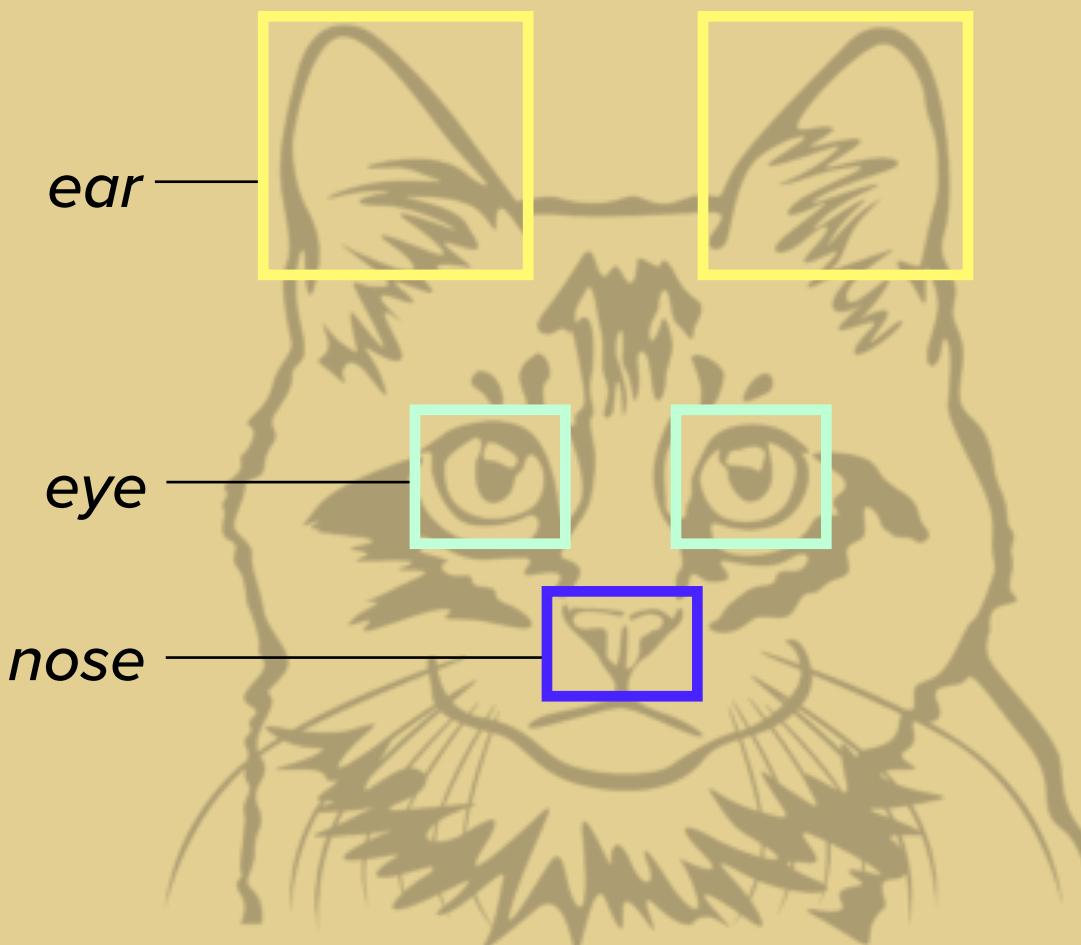
Feature Engineering

Model

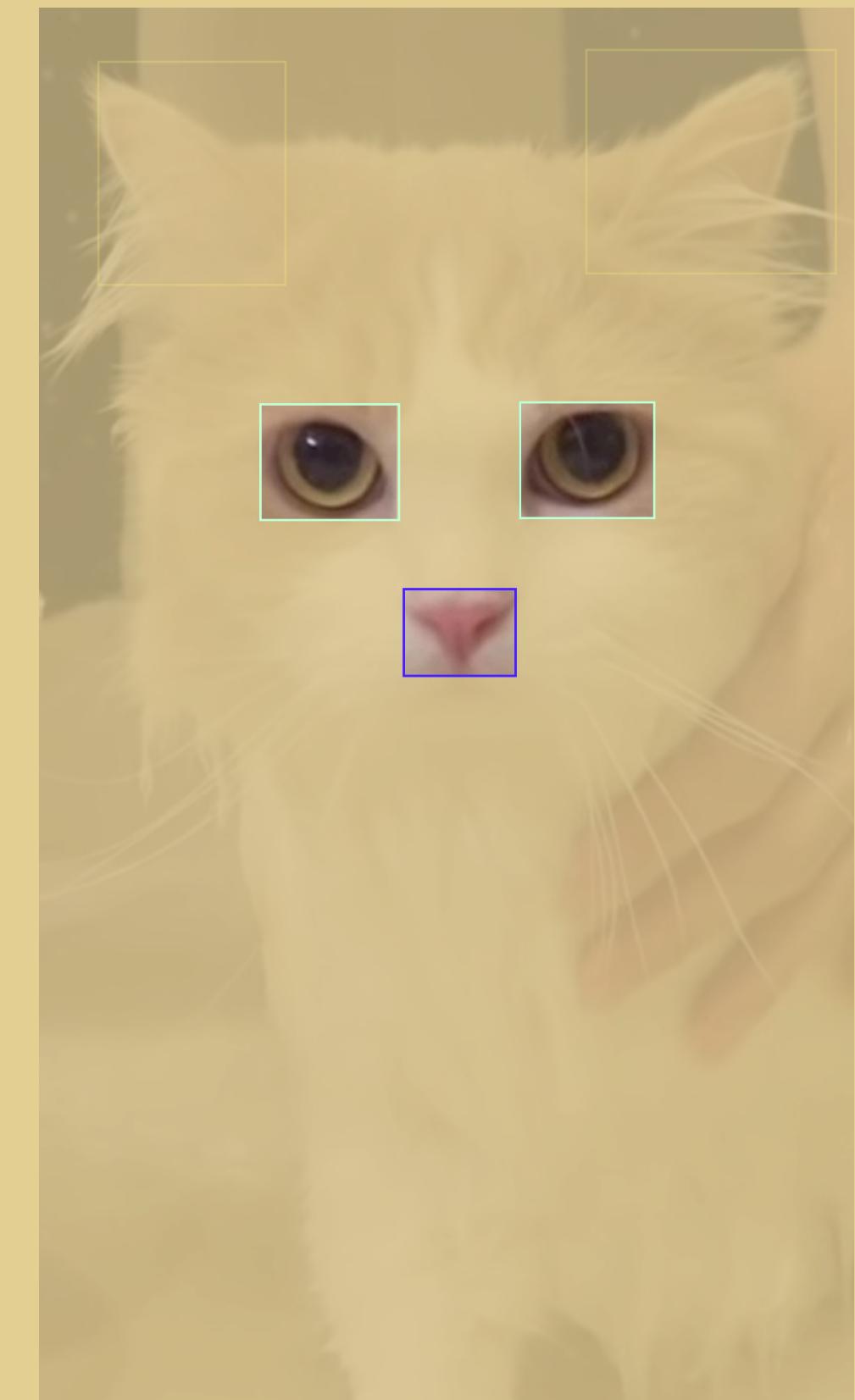
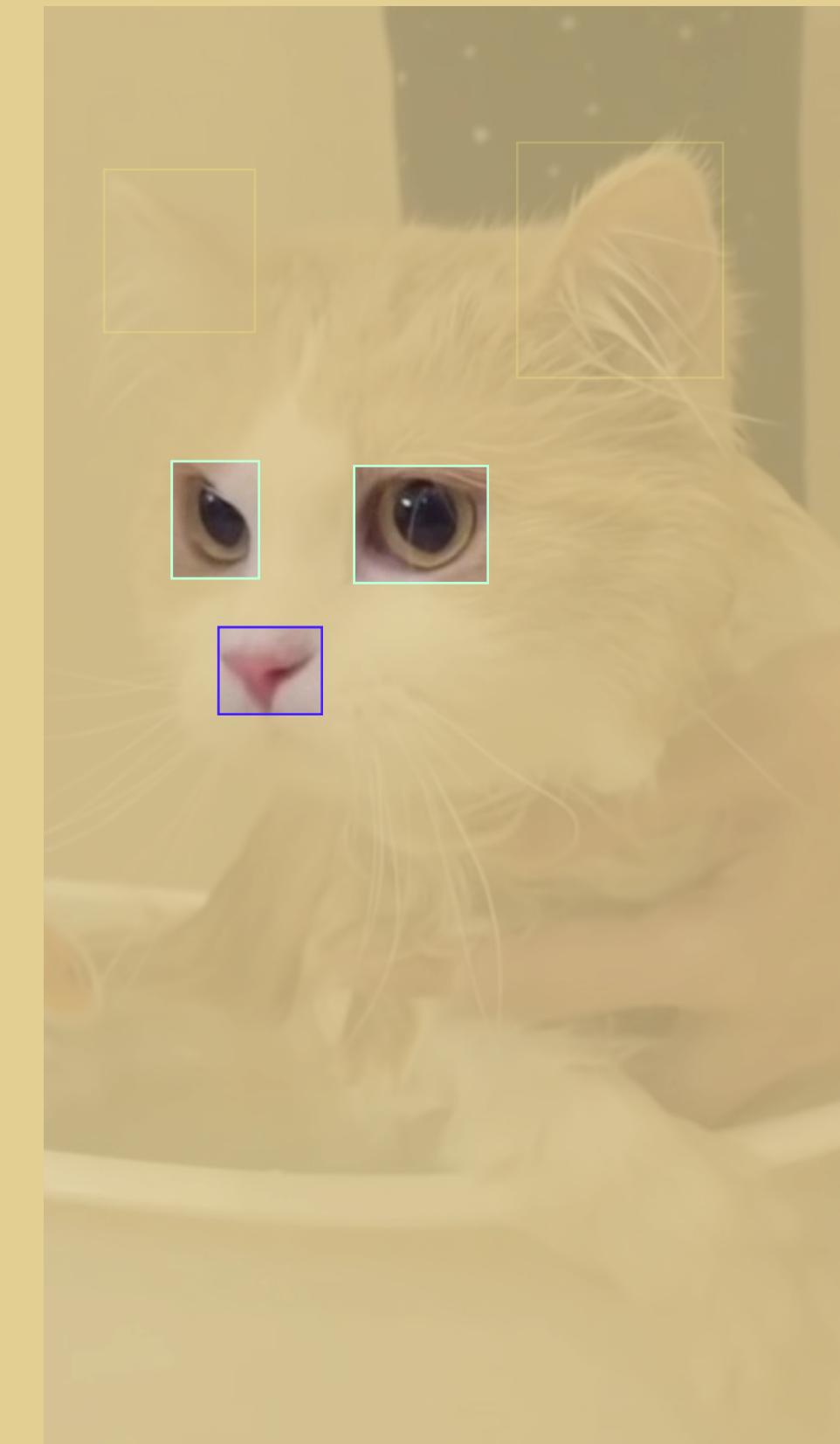
App

3. Cat facial features detection

- **Custom trained object detector**
Neural network (darknet)



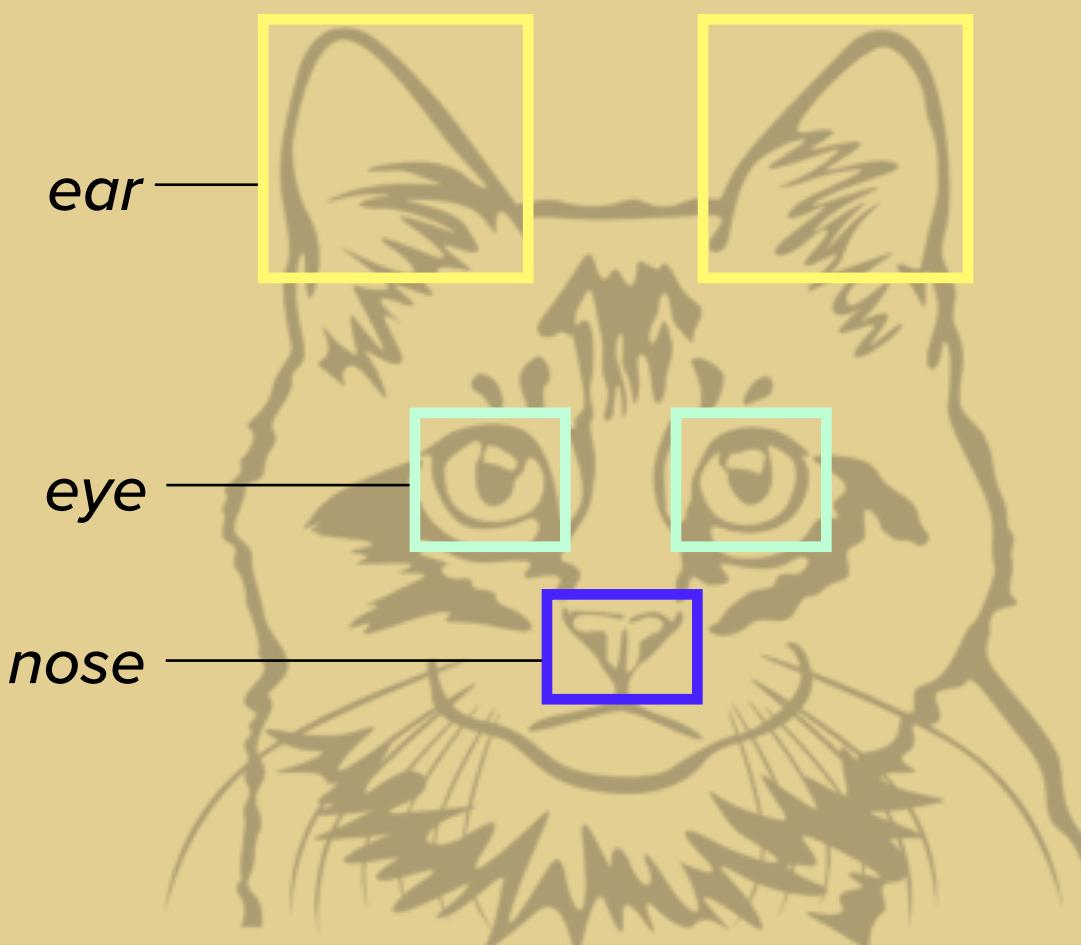
- Eyes position
- Nose position



3. Cat facial features detection

- **Custom trained object detector**

Neural network (darknet)



- Eyes position
- Nose position
- ▷ Face angle



Data

Feature Engineering

Model

App

• Good



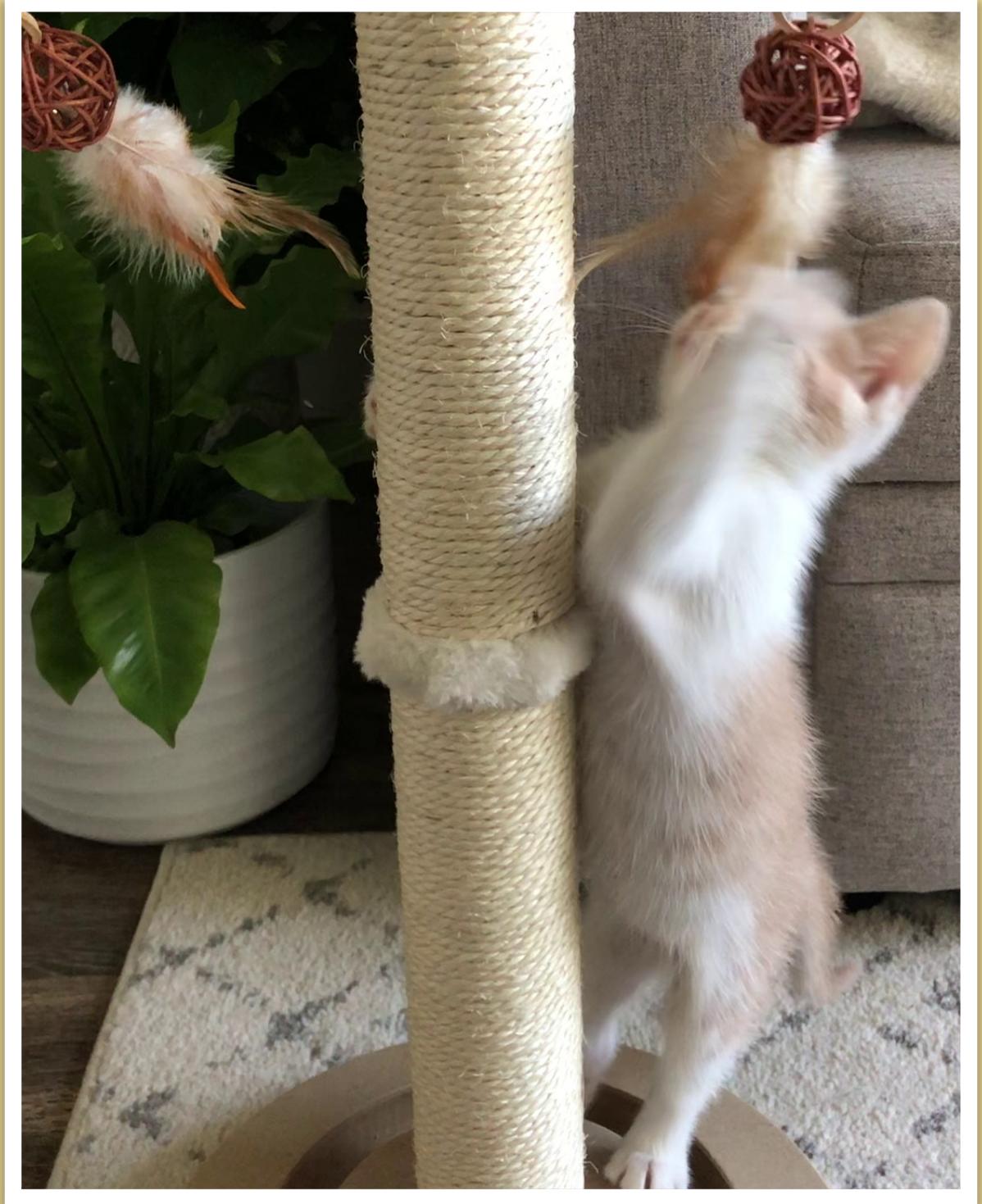
Characterization:
Features of each frame

| Feature | Value |
|---|------------|
| <input checked="" type="checkbox"/> Face position | (0.6, 0.4) |
| <input checked="" type="checkbox"/> Face size | 0.09 |
| <input checked="" type="checkbox"/> Sharpness-cat | 4800 |
| <input checked="" type="checkbox"/> Sharpness- | 2700 |
| <input checked="" type="checkbox"/> Sharpness ratio | 1.7 |
| <input checked="" type="checkbox"/> Eye position | (197, 643) |
| <input checked="" type="checkbox"/> Eye size | 0.06 |
| <input checked="" type="checkbox"/> Eye shape | 0.8 |
| <input checked="" type="checkbox"/> Nose position | (299, 789) |
| <input checked="" type="checkbox"/> Face angle | 0.7 |
| ... | ... |

- {
1. Cat face
 2. Blur
 3. Facial features

| Feature | Value |
|---|------------|
| <input checked="" type="checkbox"/> Face position | (0.9, 0.8) |
| <input checked="" type="checkbox"/> Face size | 0.07 |
| <input checked="" type="checkbox"/> Sharpness-cat | 1800 |
| <input checked="" type="checkbox"/> Sharpness- | 2700 |
| <input checked="" type="checkbox"/> Sharpness ratio | 0.6 |
| <input checked="" type="checkbox"/> Eye position | (197, 643) |
| <input checked="" type="checkbox"/> Eye size | 0.06 |
| <input checked="" type="checkbox"/> Eye shape | 0.8 |
| <input checked="" type="checkbox"/> Nose position | (299, 789) |
| <input checked="" type="checkbox"/> Face angle | 0.3 |
| ... | ... |

• Bad



Data

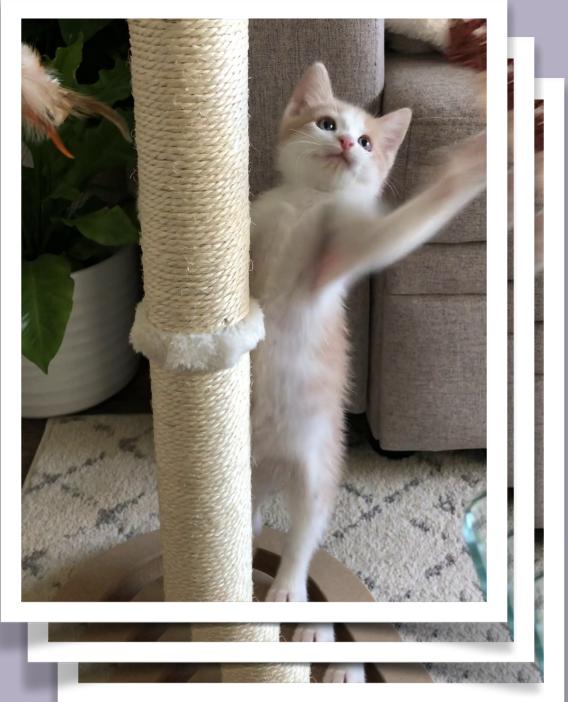
Feature Engineering

Model

App

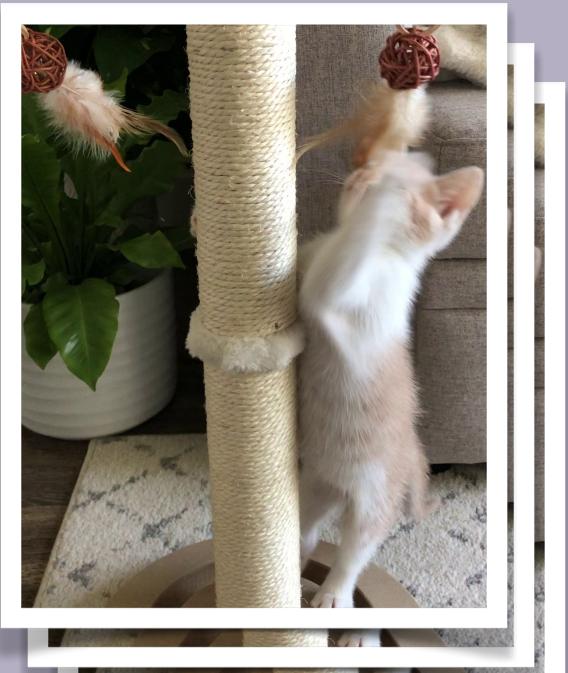
Training

frame



• Good

| Feature | Value |
|---|------------|
| <input checked="" type="checkbox"/> Face position | 0.4-0.6 |
| <input checked="" type="checkbox"/> Face size | 0.09 |
| <input checked="" type="checkbox"/> Sharpness-cat | 4000 |
| <input checked="" type="checkbox"/> Sharpness- | 2700 |
| <input checked="" type="checkbox"/> Sharpness ratio | 17 |
| <input checked="" type="checkbox"/> Eye position | (997, 643) |
| <input checked="" type="checkbox"/> Eye size | 0.06 |
| <input checked="" type="checkbox"/> Eye shape | 0.8 |
| <input checked="" type="checkbox"/> Nose position | (299, 789) |
| <input checked="" type="checkbox"/> Face angle | 0.7 |
| ... | - |



• Bad

| Feature | Value |
|---|------------|
| <input checked="" type="checkbox"/> Face position | 0.4-0.6 |
| <input checked="" type="checkbox"/> Face size | 0.09 |
| <input checked="" type="checkbox"/> Sharpness-cat | 4000 |
| <input checked="" type="checkbox"/> Sharpness- | 2700 |
| <input checked="" type="checkbox"/> Sharpness ratio | 17 |
| <input checked="" type="checkbox"/> Eye position | (997, 643) |
| <input checked="" type="checkbox"/> Eye size | 0.06 |
| <input checked="" type="checkbox"/> Eye shape | 0.8 |
| <input checked="" type="checkbox"/> Nose position | (299, 789) |
| <input checked="" type="checkbox"/> Face angle | 0.7 |
| ... | - |

Data

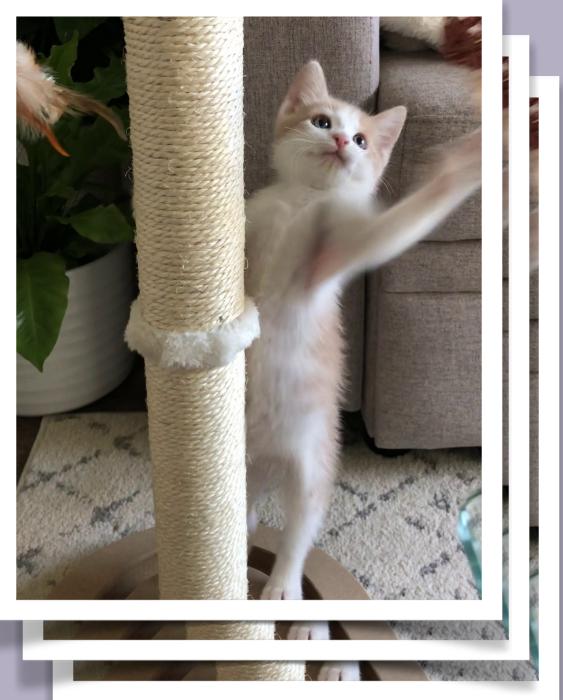
Feature Engineering

Model

App

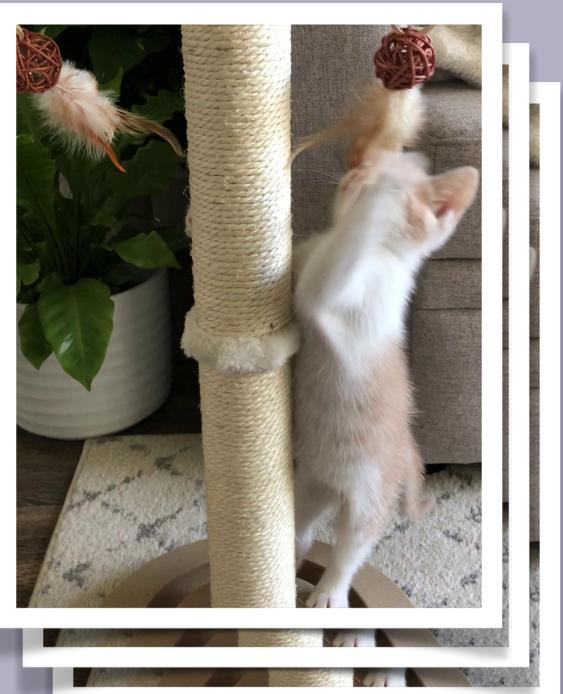
Training

frame, label



• Good

| Feature | Value |
|---|------------|
| <input checked="" type="checkbox"/> Face position | 0.4-0.6 |
| <input checked="" type="checkbox"/> Face size | 0.09 |
| <input checked="" type="checkbox"/> Sharpness-cat | 4000 |
| <input checked="" type="checkbox"/> Sharpness- | 2700 |
| <input checked="" type="checkbox"/> Sharpness ratio | 17 |
| <input checked="" type="checkbox"/> Eye position | (997, 643) |
| <input checked="" type="checkbox"/> Eye size | 0.06 |
| <input checked="" type="checkbox"/> Eye shape | 0.8 |
| <input checked="" type="checkbox"/> Nose position | (299, 789) |
| <input checked="" type="checkbox"/> Face angle | 0.7 |
| ... | - |



• Bad

| Feature | Value |
|---|------------|
| <input checked="" type="checkbox"/> Face position | 0.4-0.6 |
| <input checked="" type="checkbox"/> Face size | 0.09 |
| <input checked="" type="checkbox"/> Sharpness-cat | 4000 |
| <input checked="" type="checkbox"/> Sharpness- | 2700 |
| <input checked="" type="checkbox"/> Sharpness ratio | 17 |
| <input checked="" type="checkbox"/> Eye position | (997, 643) |
| <input checked="" type="checkbox"/> Eye size | 0.06 |
| <input checked="" type="checkbox"/> Eye shape | 0.8 |
| <input checked="" type="checkbox"/> Nose position | (299, 789) |
| <input checked="" type="checkbox"/> Face angle | 0.7 |
| ... | - |

Data

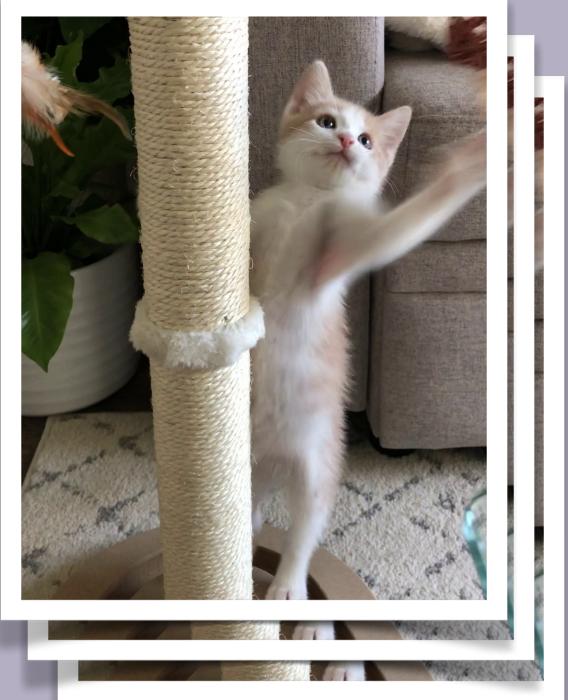
Feature Engineering

Model

App

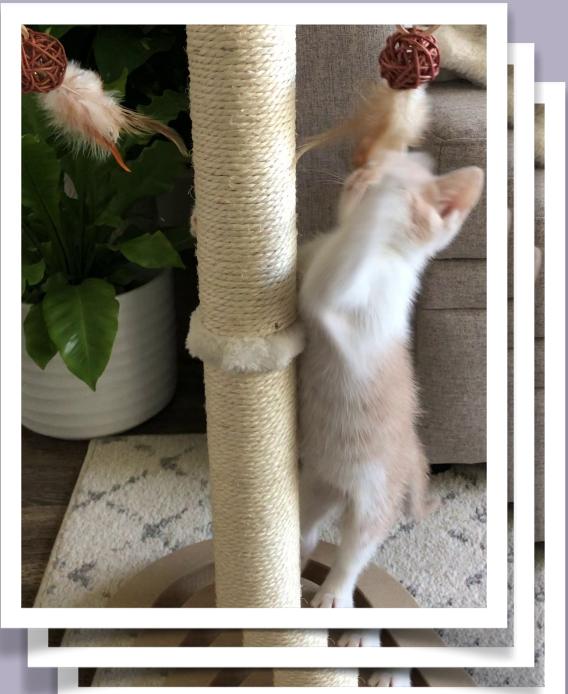
Training

frame, label, features



• Good

| Feature | Value |
|-----------------|------------|
| Face position | [0.4, 0.4] |
| Face size | 0.09 |
| Sharpness-cat | 4800 |
| Sharpness- | 2700 |
| Sharpness ratio | 17 |
| Eye position | [897, 442] |
| Eye size | 0.06 |
| Eye shape | 0.8 |
| Nose position | [399, 789] |
| Face angle | 0.7 |
| ... | - |



• Bad

| Feature | Value |
|-----------------|------------|
| Face position | [0.4, 0.4] |
| Face size | 0.09 |
| Sharpness-cat | 4800 |
| Sharpness- | 2700 |
| Sharpness ratio | 17 |
| Eye position | [897, 442] |
| Eye size | 0.06 |
| Eye shape | 0.8 |
| Nose position | [399, 789] |
| Face angle | 0.7 |
| ... | - |

Data

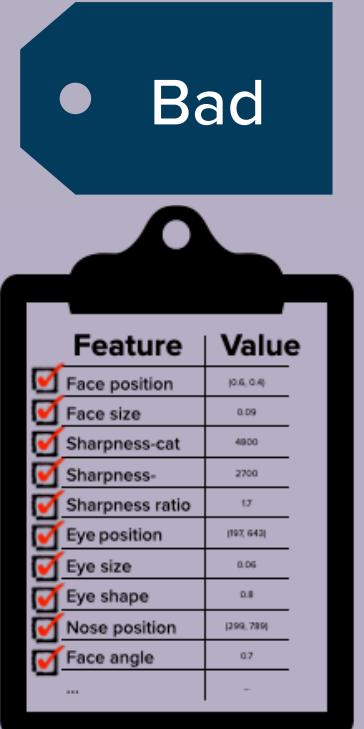
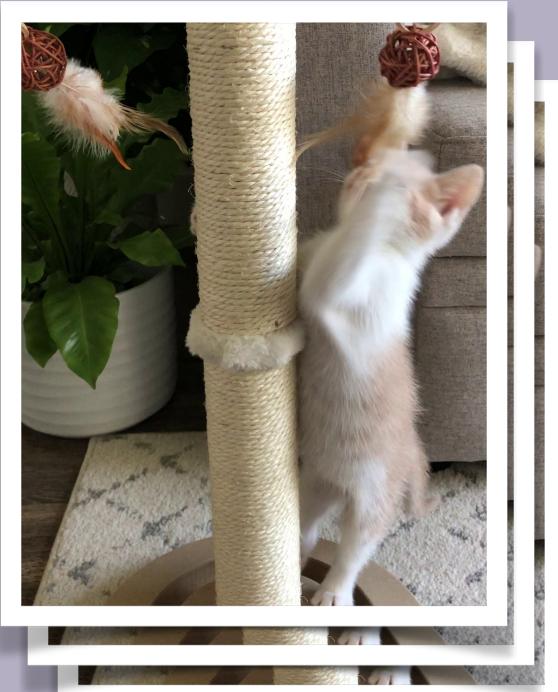
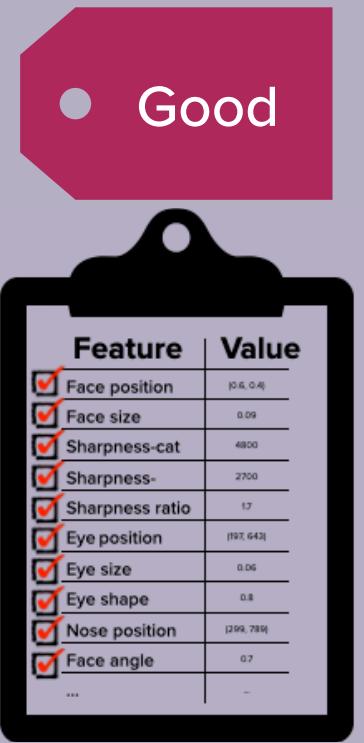
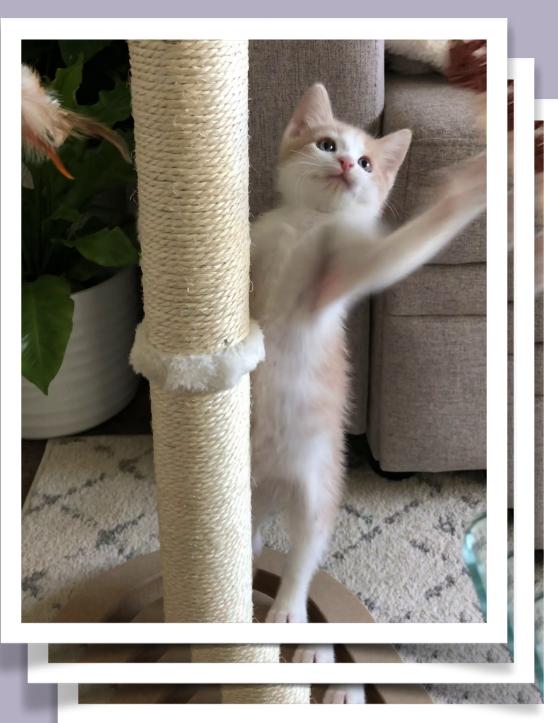
Feature Engineering

Model

App

Training

frame, label, features



Random forest classifier



Data

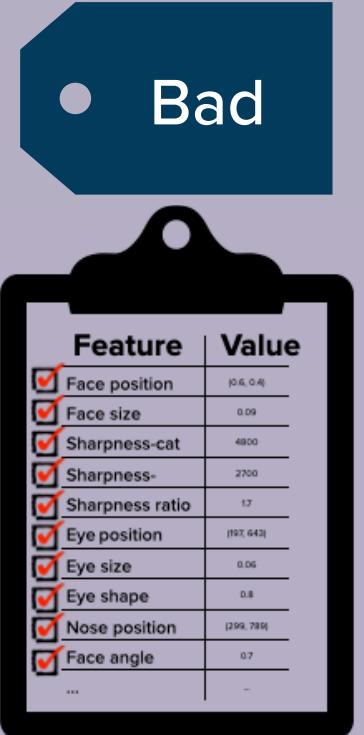
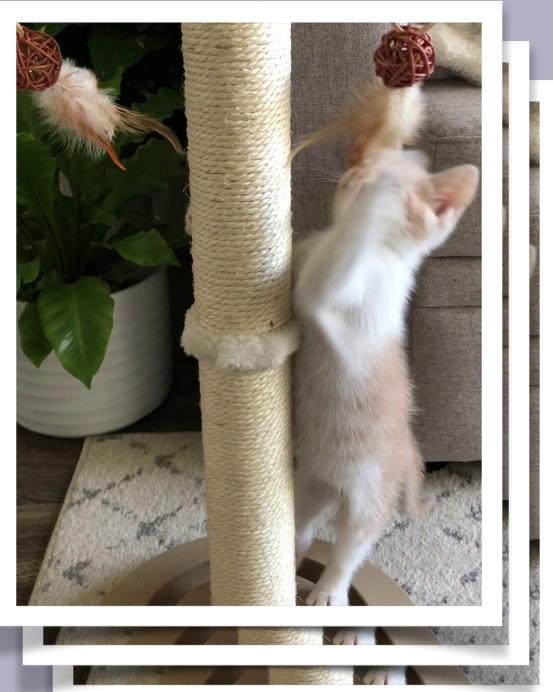
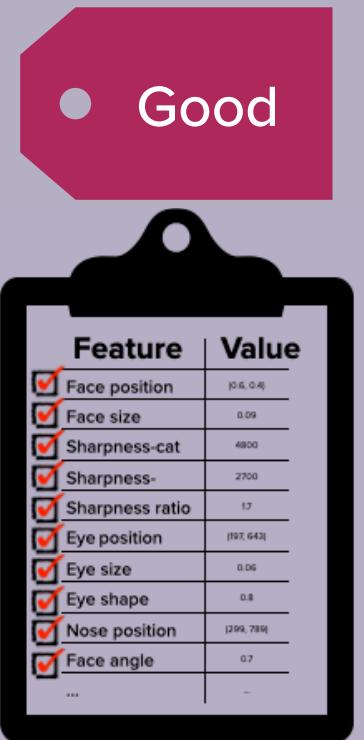
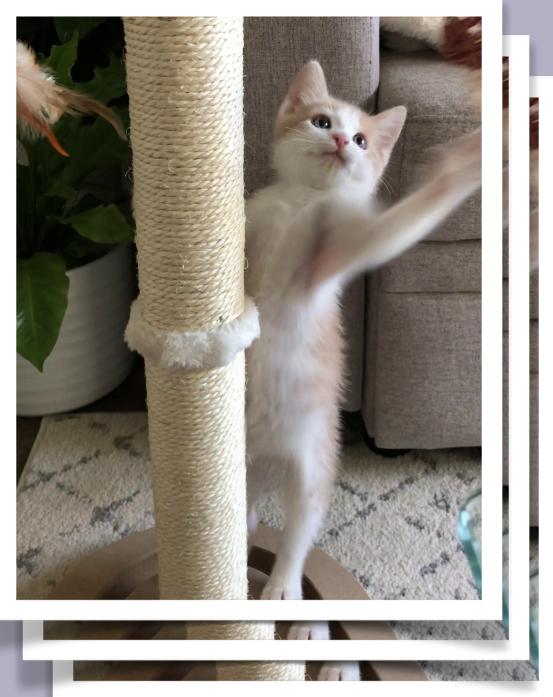
Feature Engineering

Model

App

Training

frame, label, features



Random forest classifier



Important features

Score on
contribution to model's prediction

Data

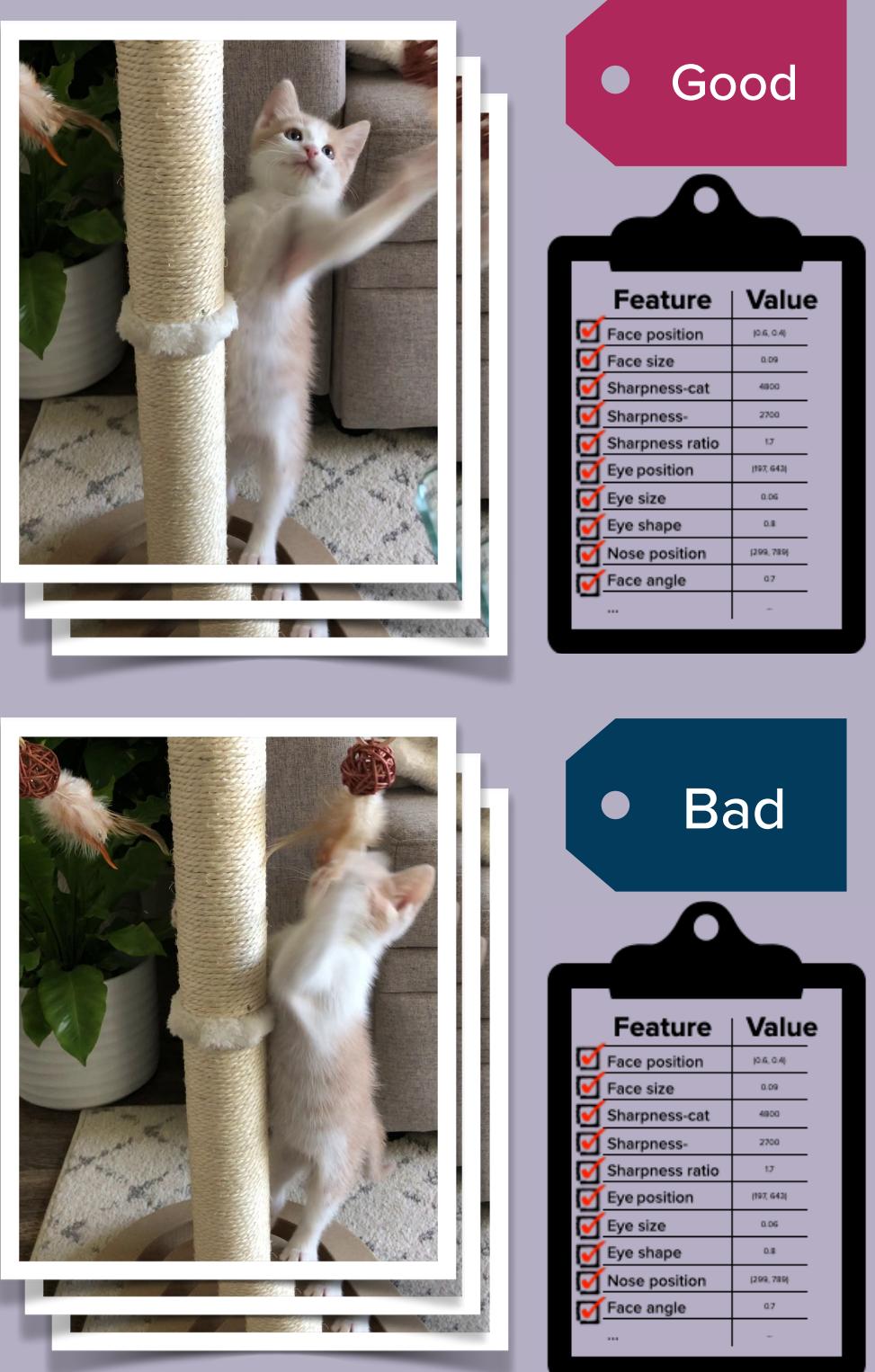
Feature Engineering

Model

App

Training

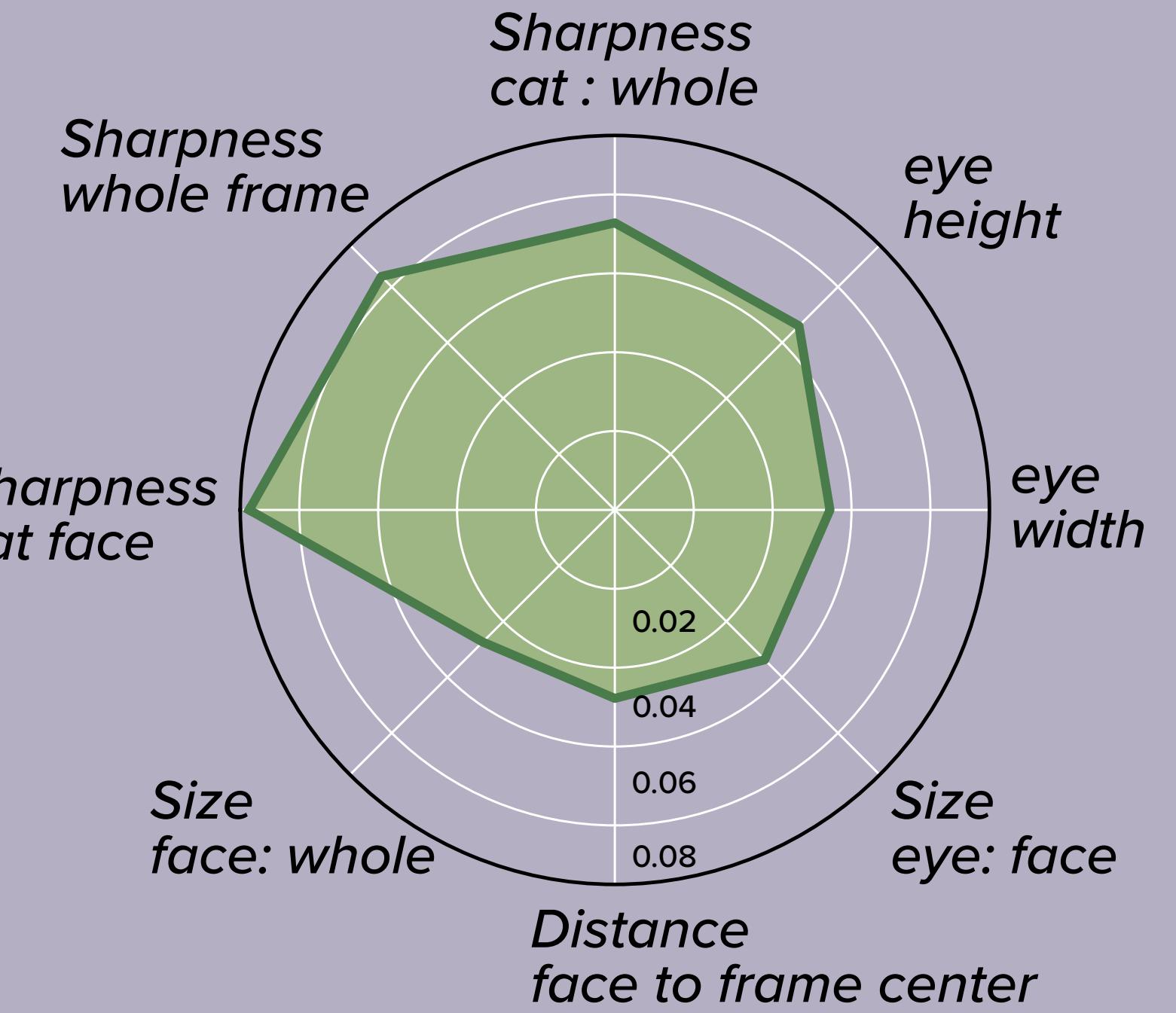
frame, label, features



Random forest classifier



Important features



Data

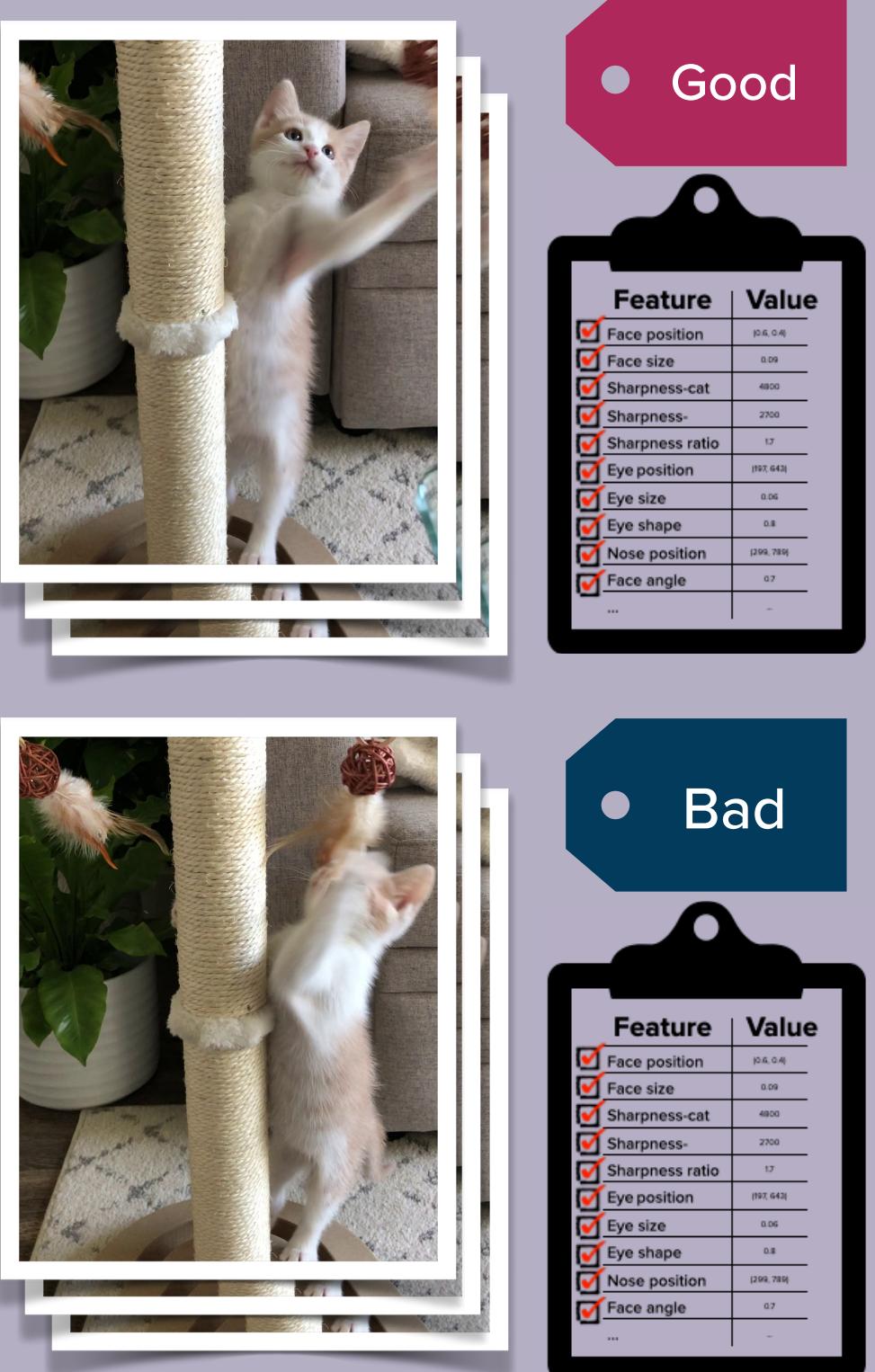
Feature Engineering

Model

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Training

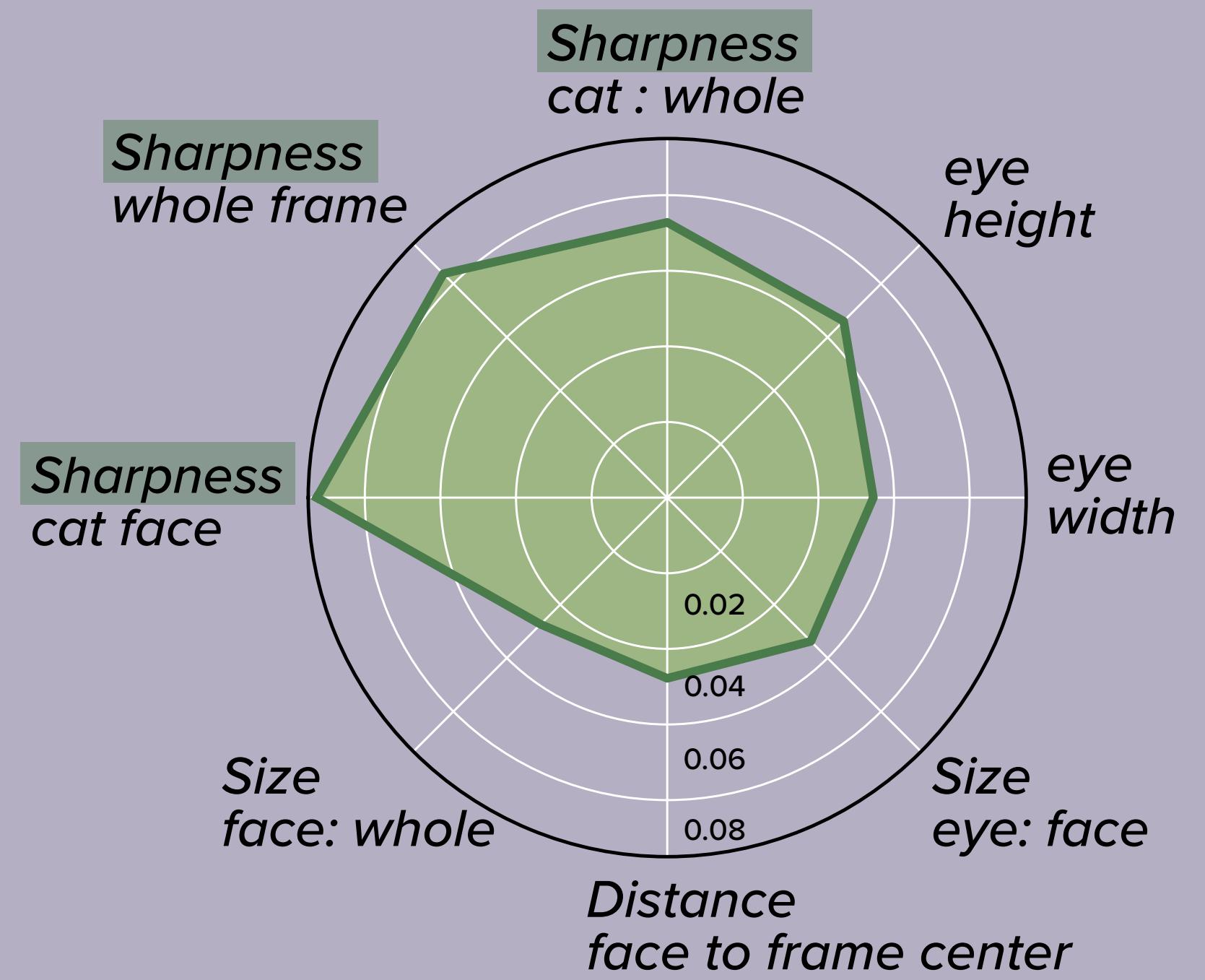
frame, label, features



Random forest classifier



Important features



Data

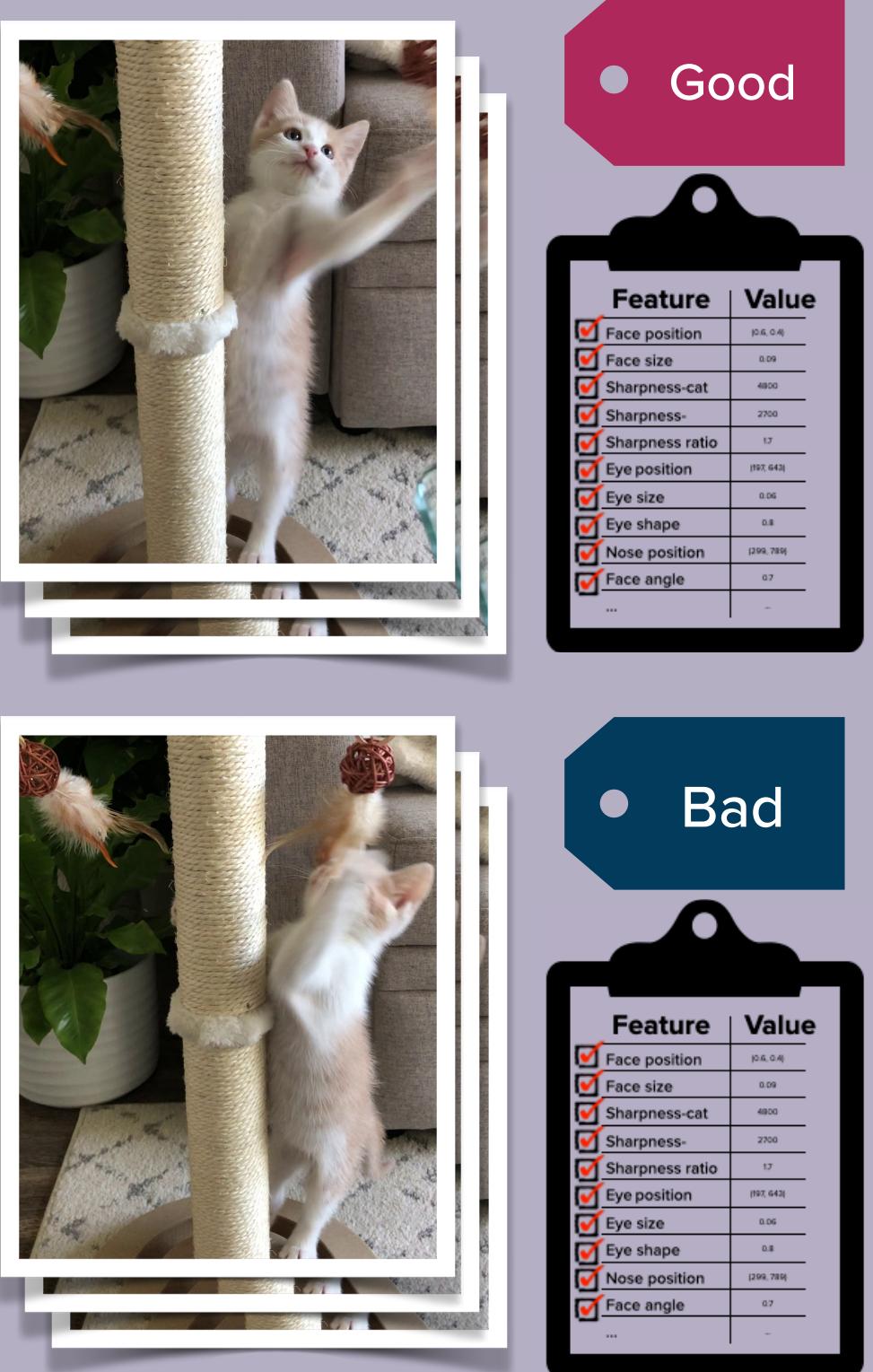
Feature Engineering

Model

App

Training

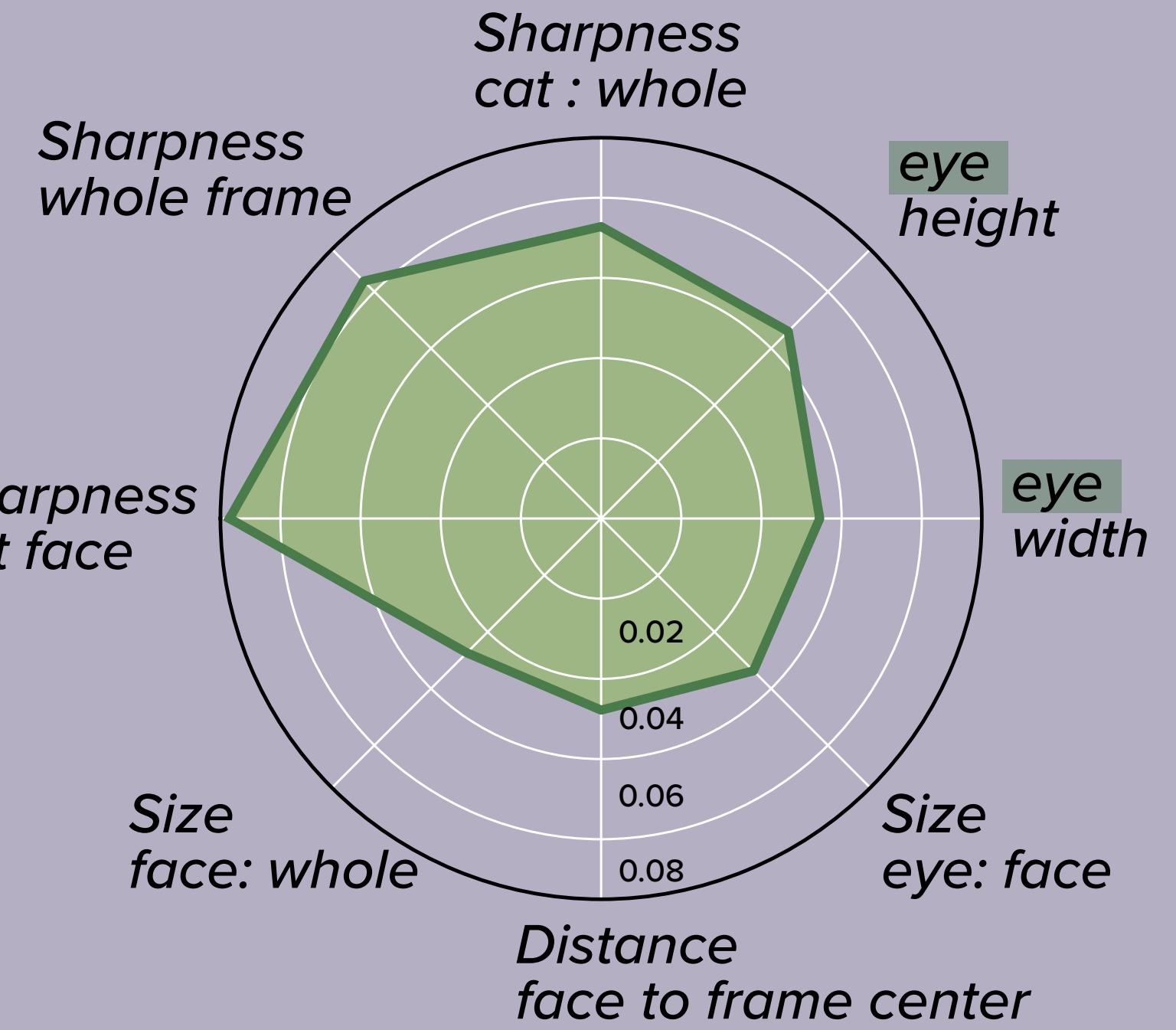
frame, label, features



Random forest classifier



Important features



Data

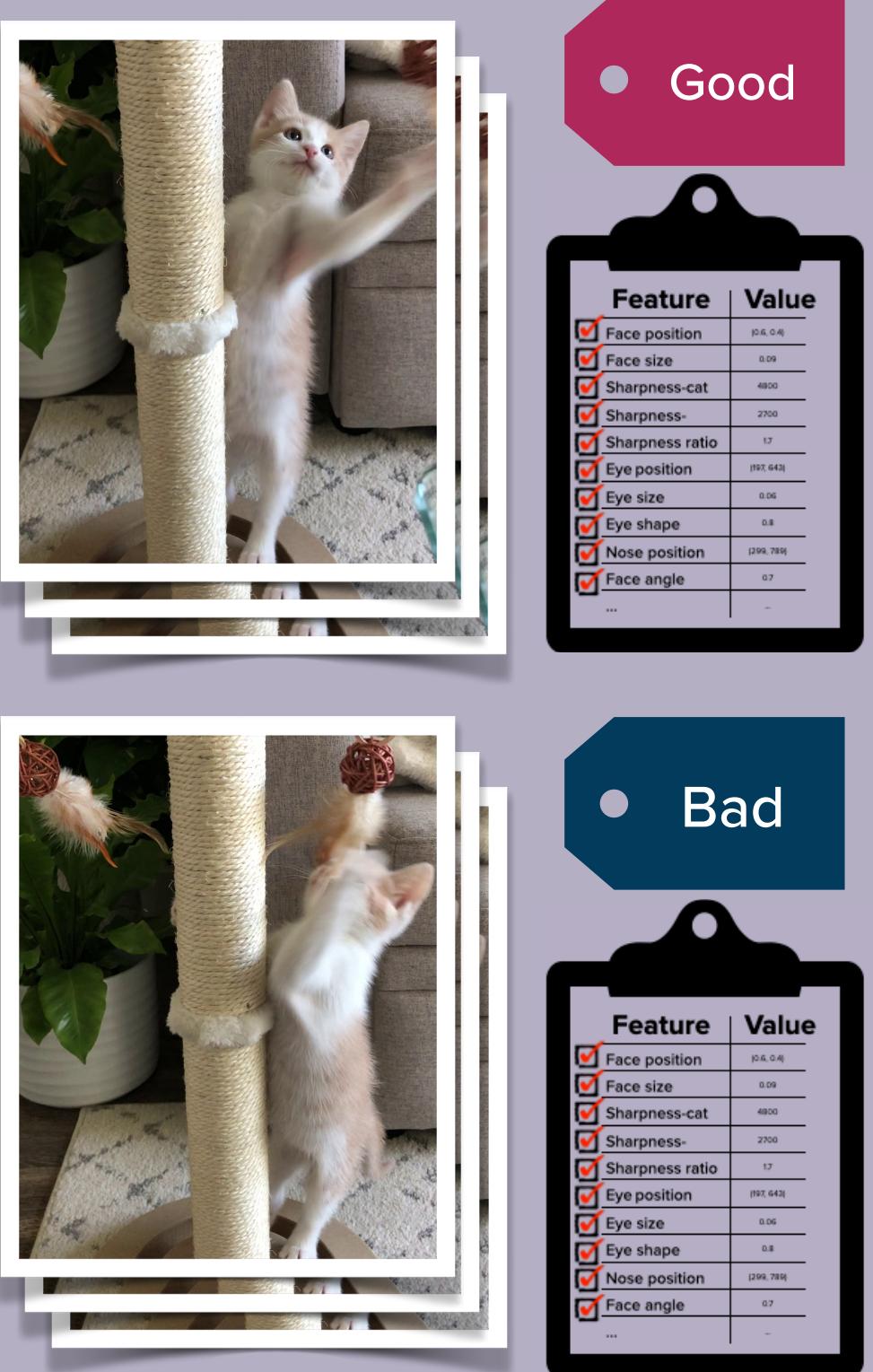
Feature Engineering

Model

App

Training

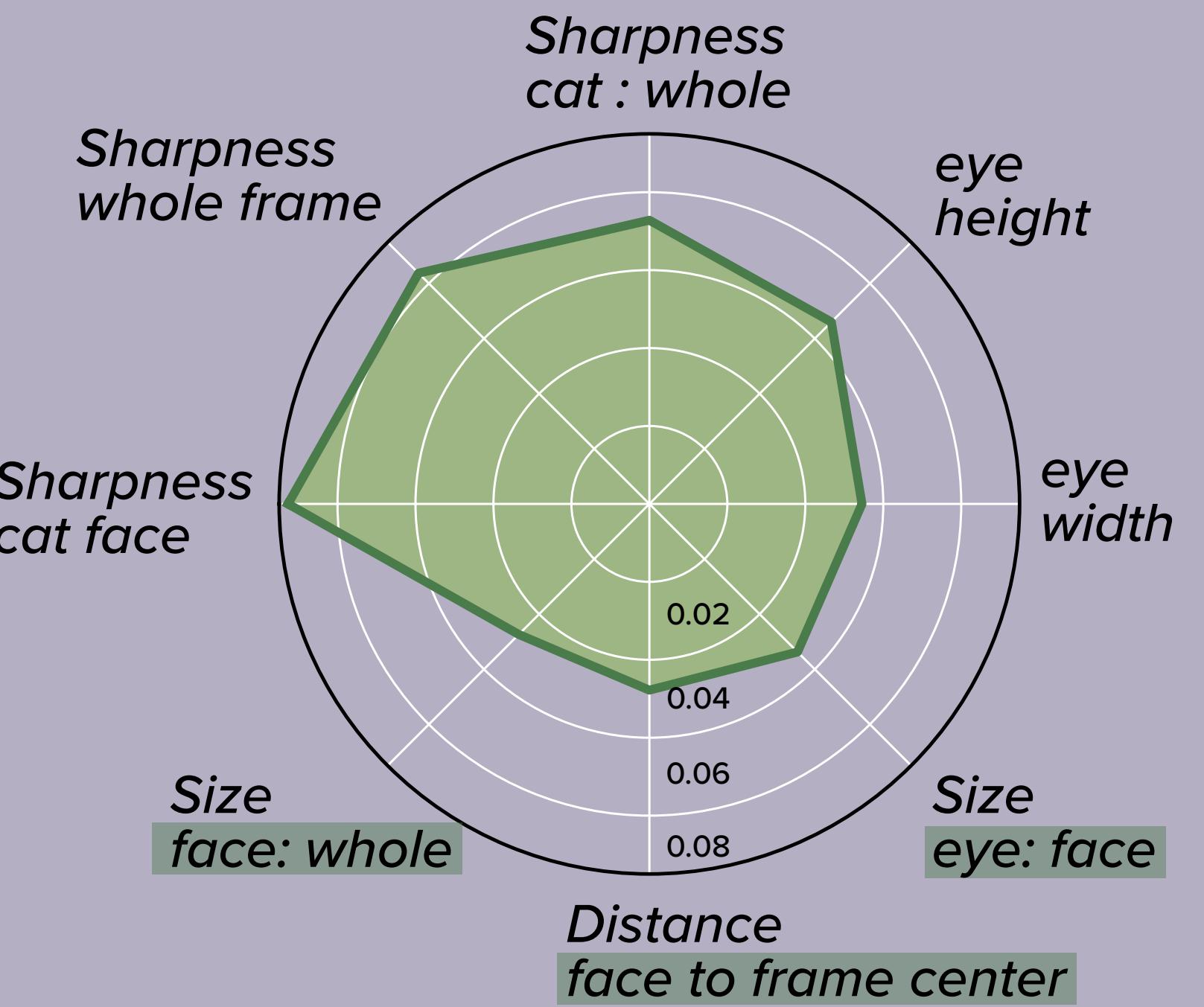
frame, label, features



Random forest classifier



Important features



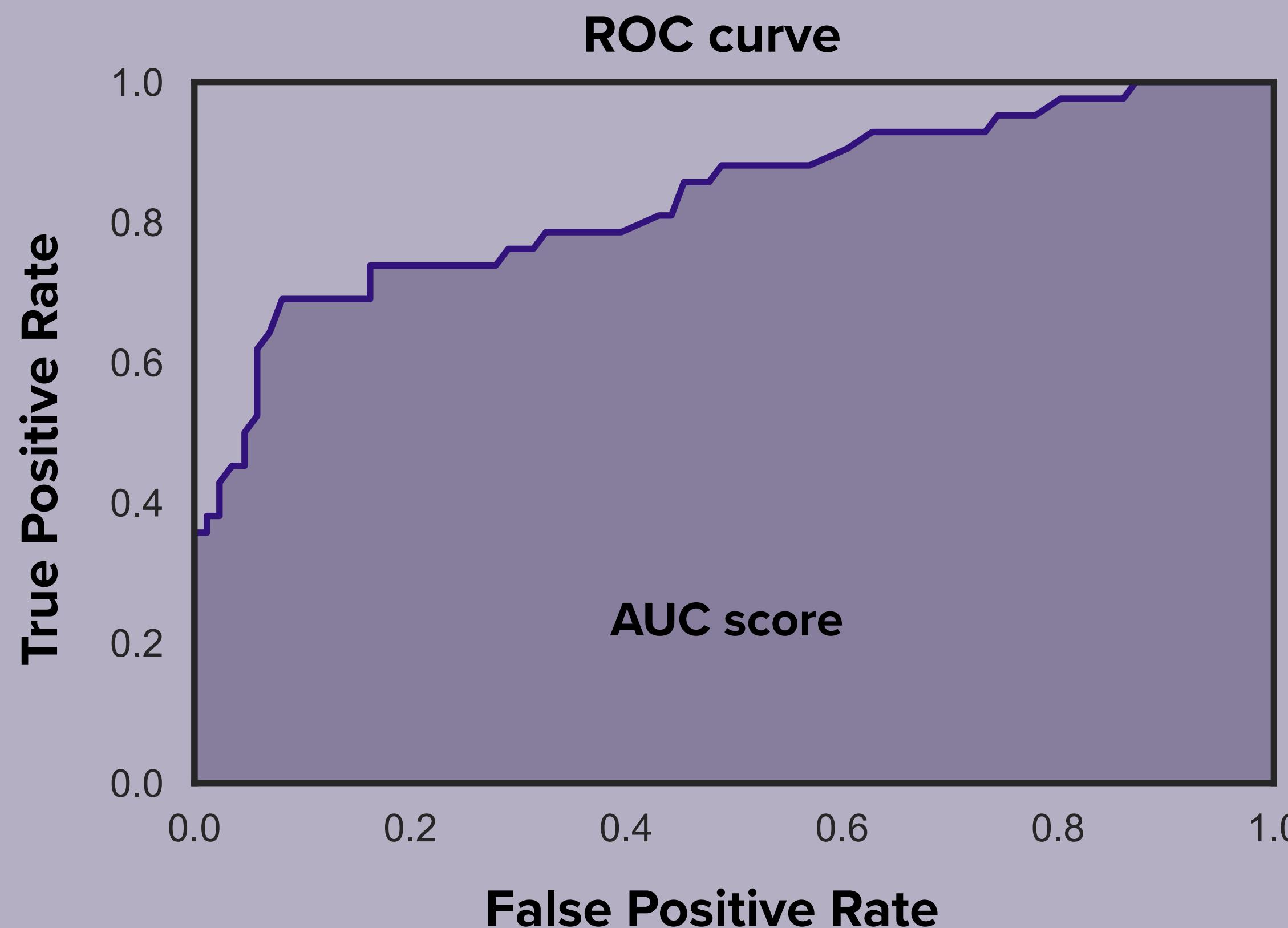
Data

Feature Engineering

Model

App

Evaluation



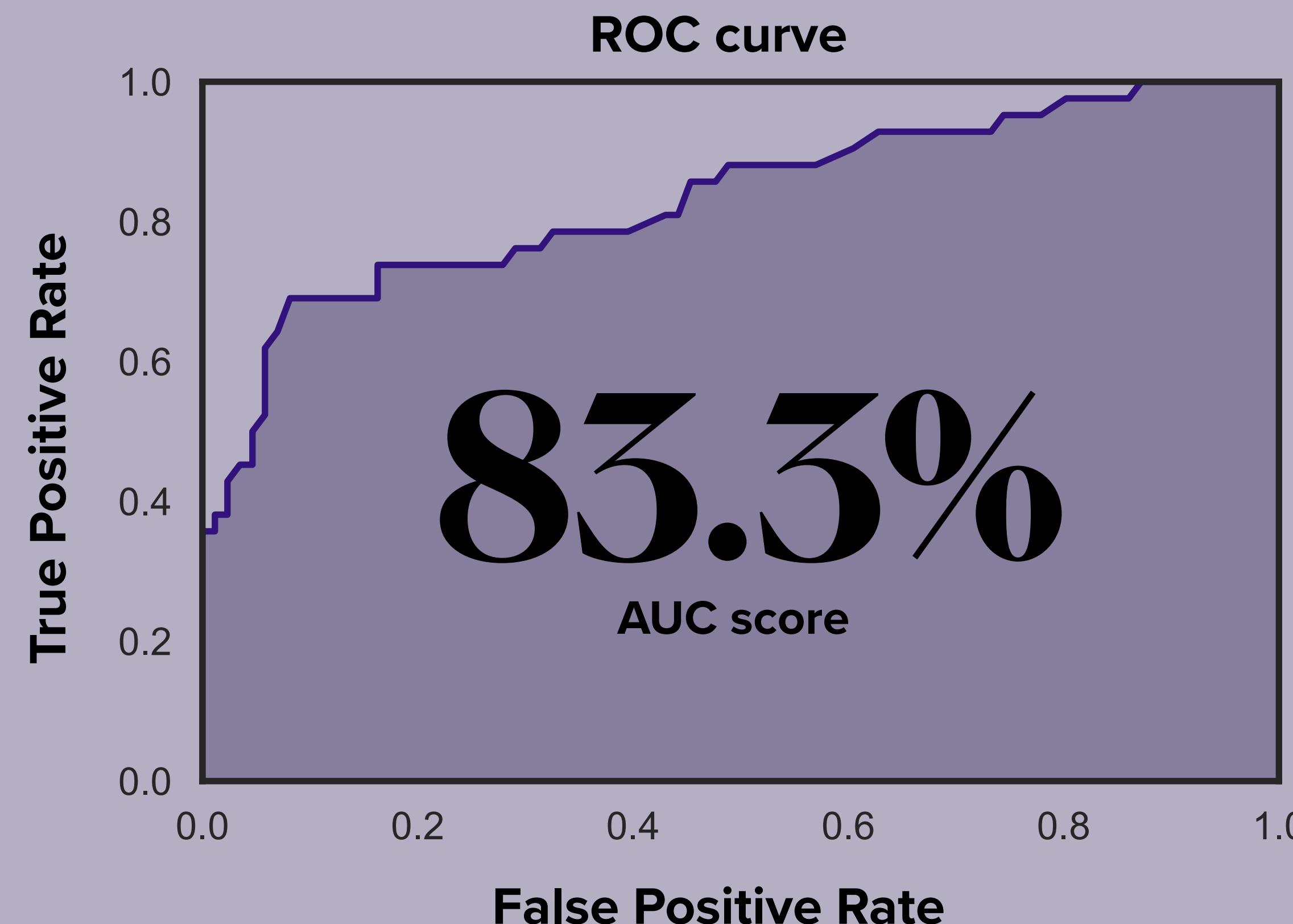
Data

Feature Engineering

Model

App

Evaluation



Data

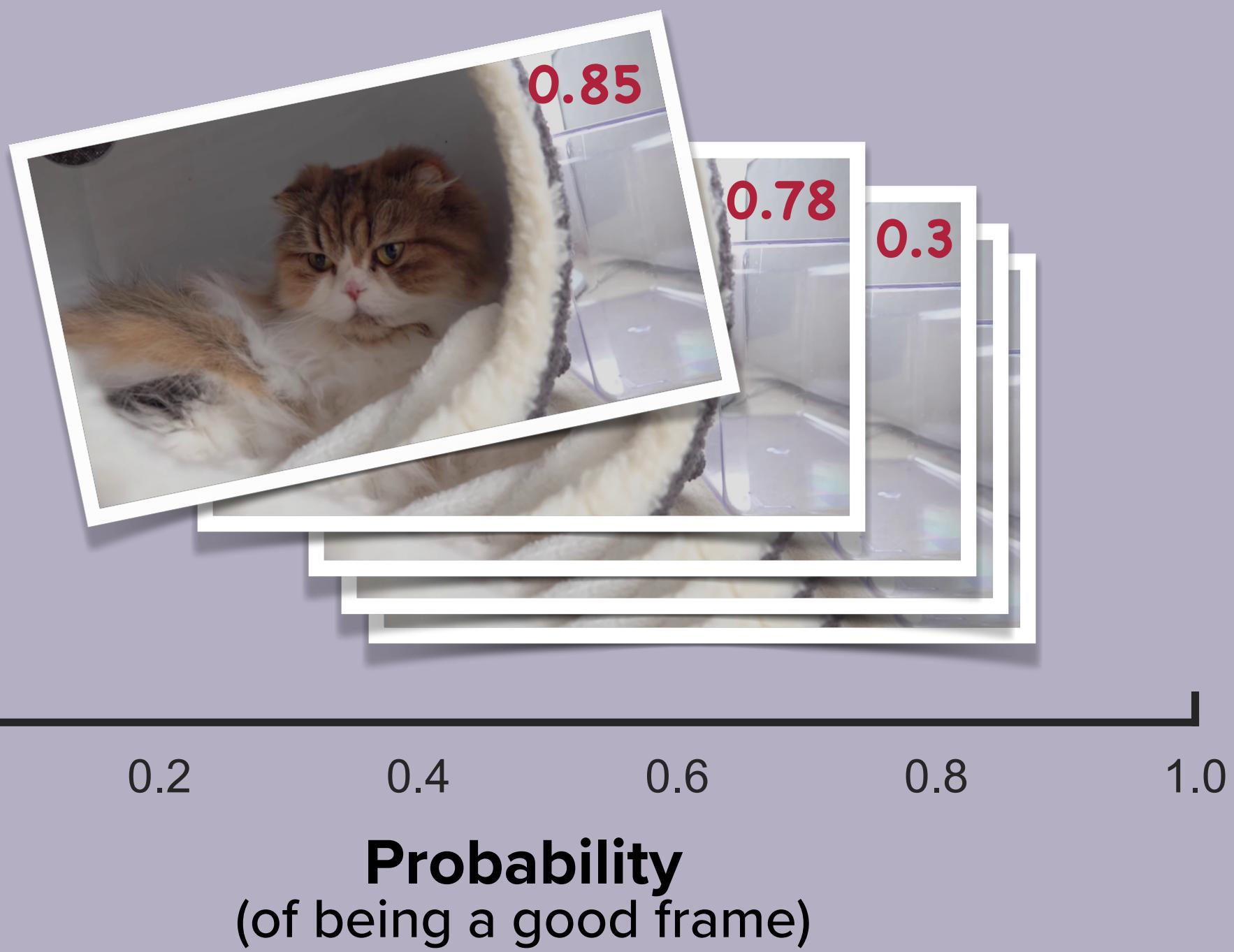
Feature Engineering

Model

App

Performance

Test set frames



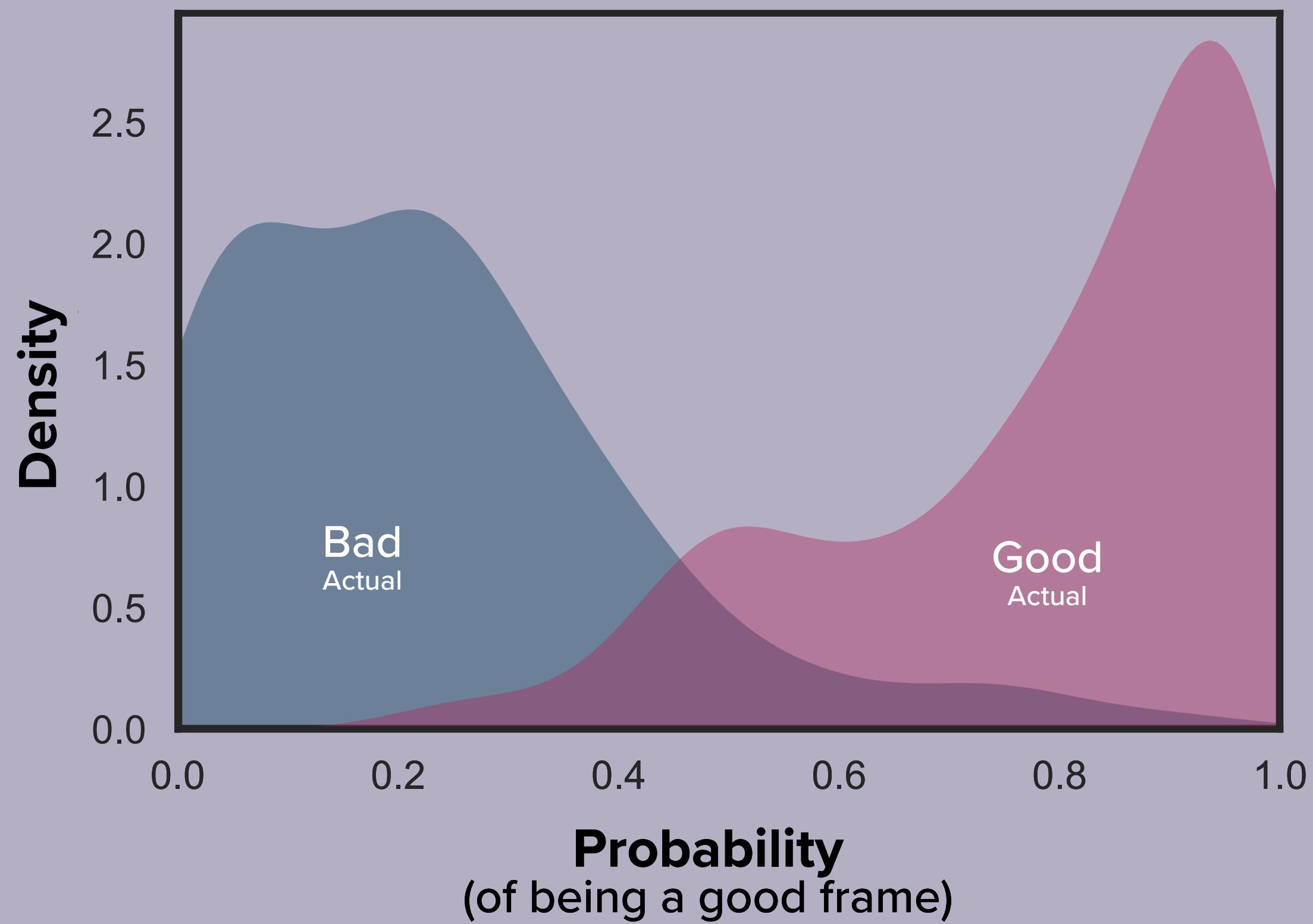
Data

Feature Engineering

Model

App

Performance



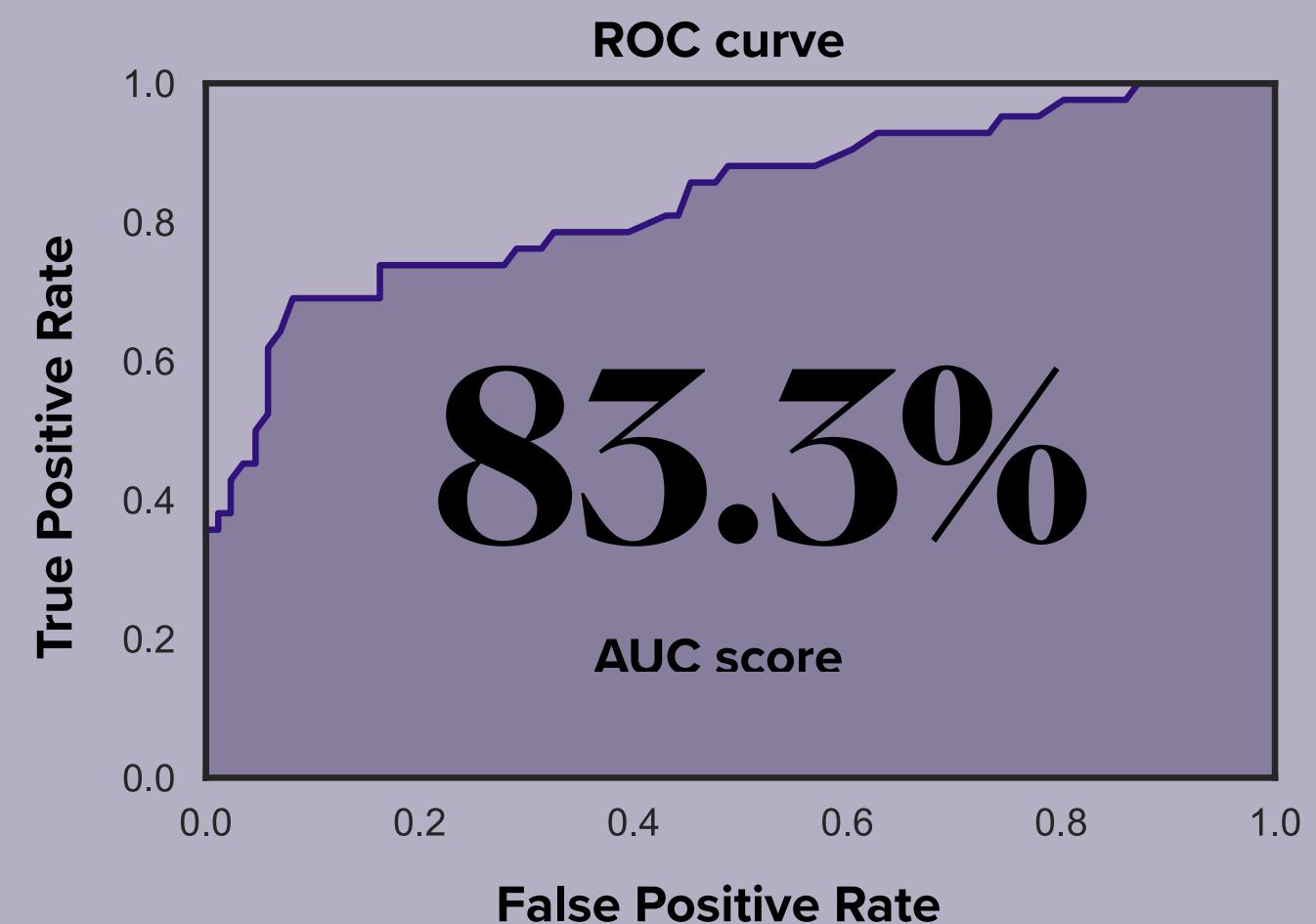
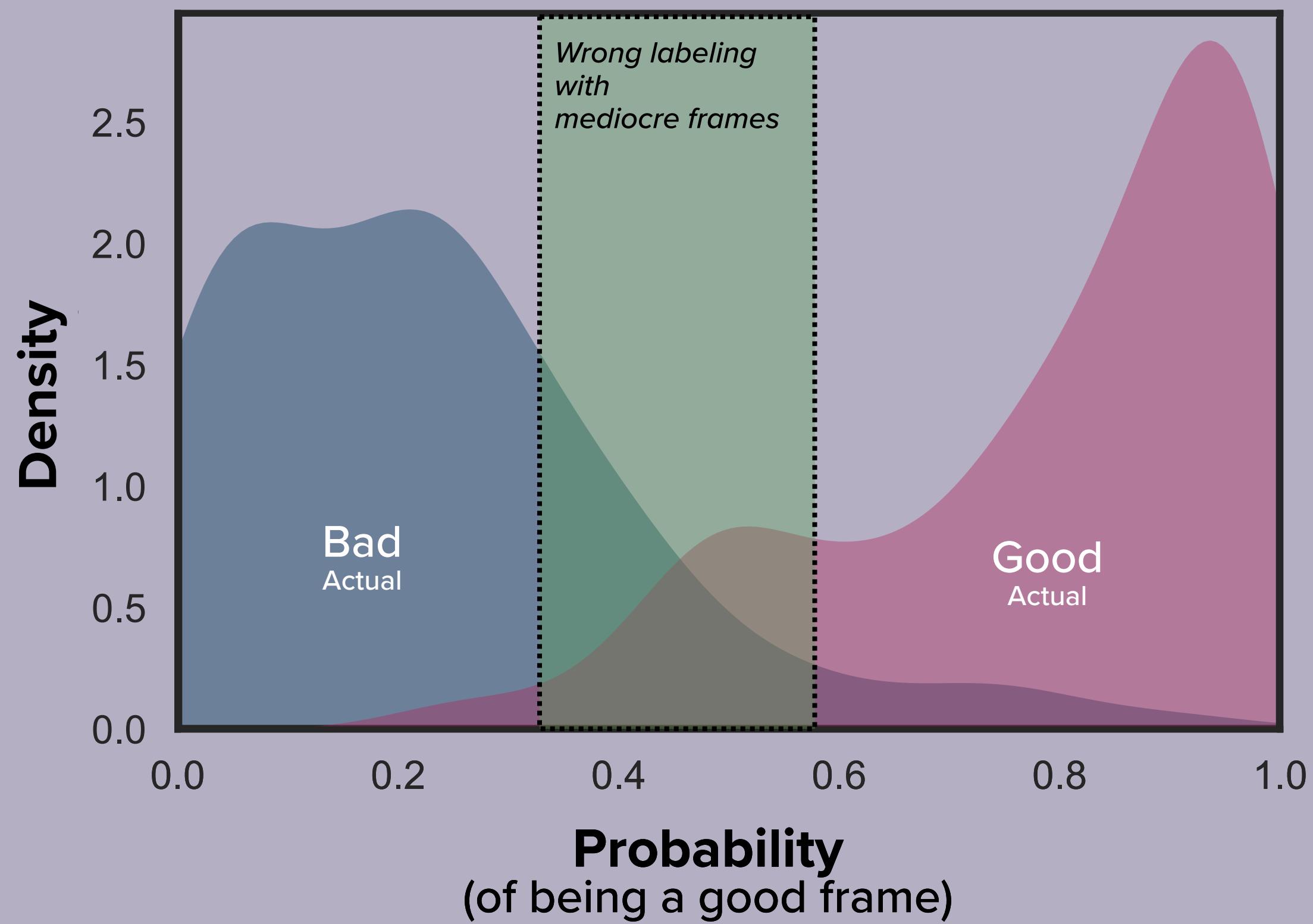
Data

Feature Engineering

Model

App

Performance



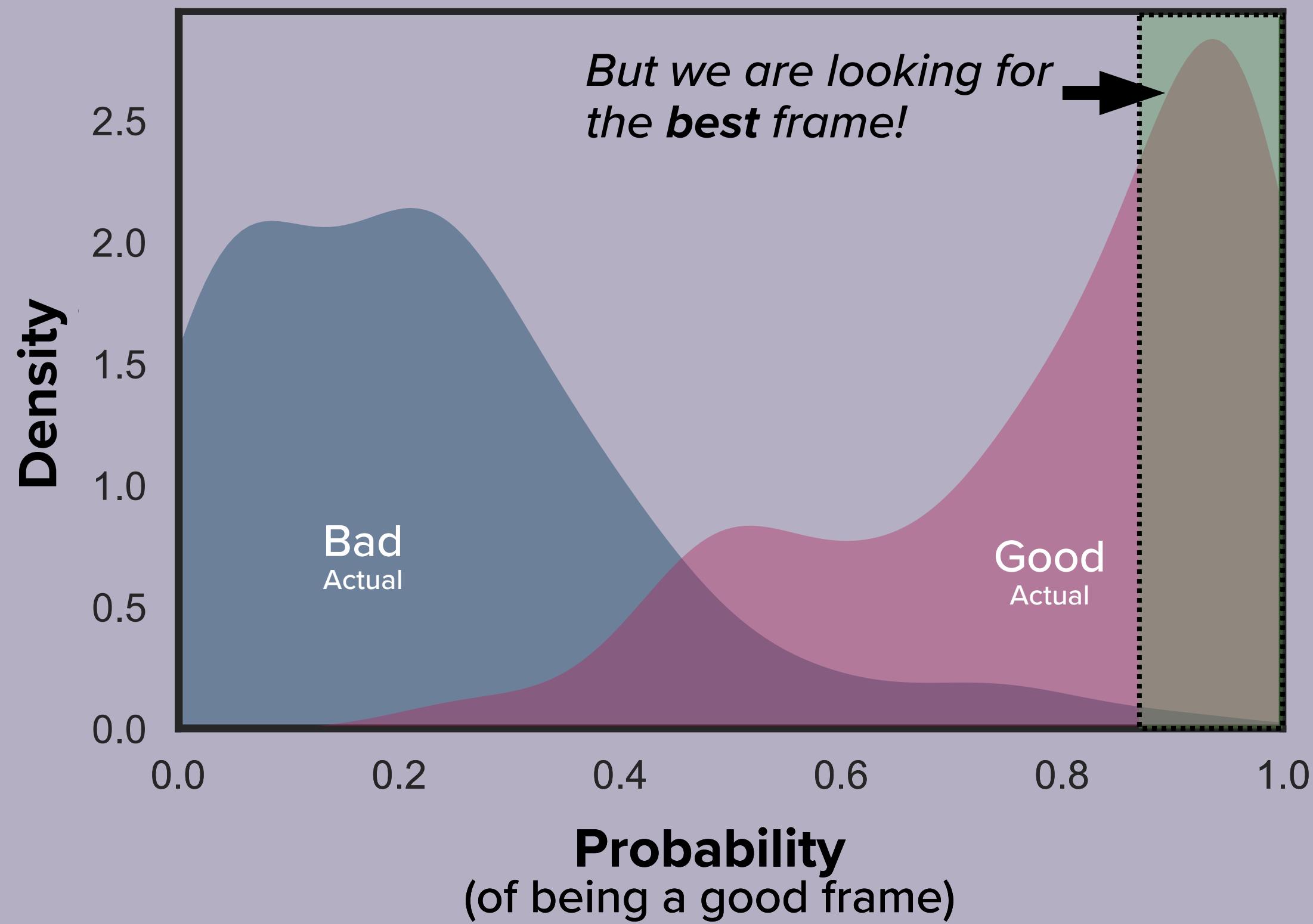
Data

Feature Engineering

Model

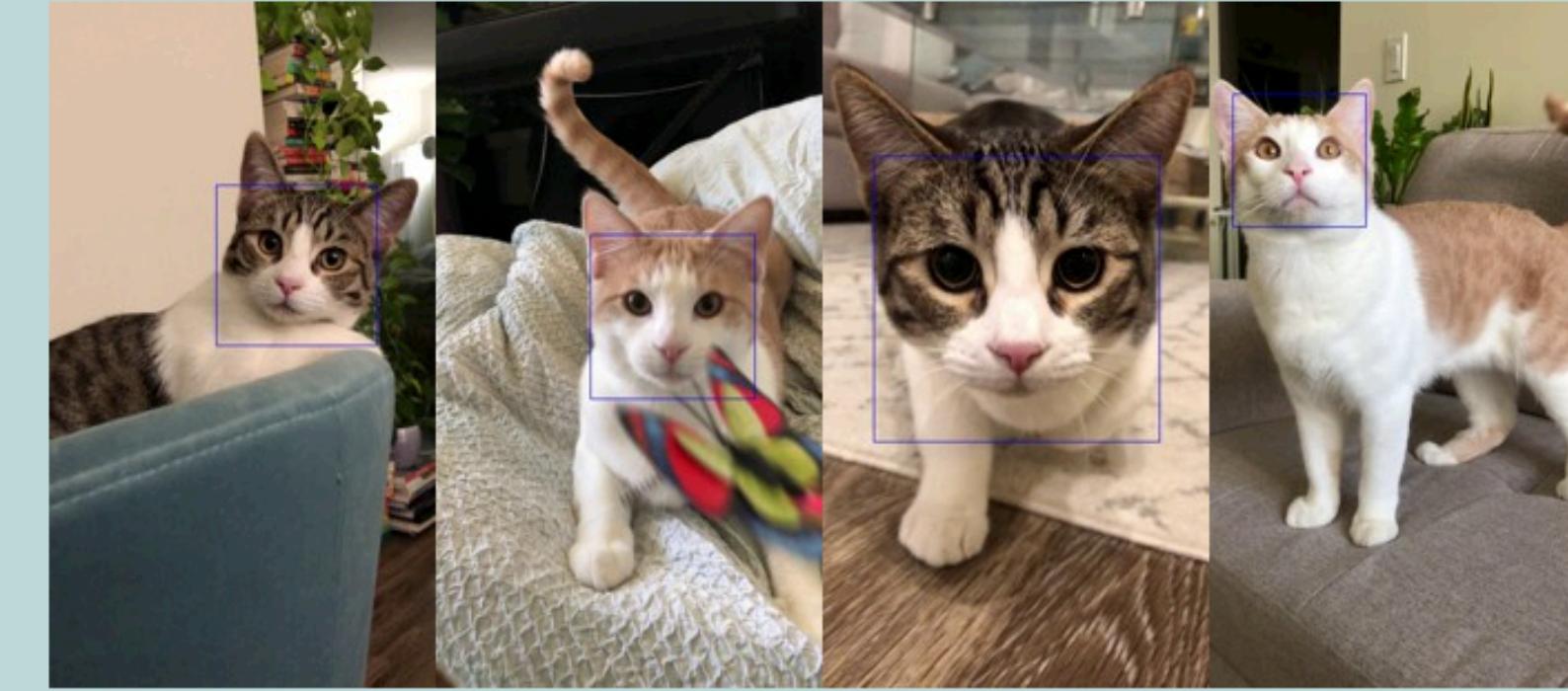
App

Performance



Welcome to Picture Purrfect!

Capture the best moment with your furry friend!



Ever struggled to take a good picture for your cat?

We tend to take a bunch of photos in fear of missing out. Especially for cute animals since it's even more difficult to capture a good one when you cannot tell them to hold still. Afterwards, it's extremely time-consuming to go through all the photos and manually select the best one to keep.

Now you can let Picture Purrfect do the hard job for you! Just take a short video of your cat and the best moment will be picked automatically!

X

MENU

Your purrfect pic

MADE BY KATIE HUANG 2021

Welcome to Picture Purrfect!

Upload a new video

Upload your video here:

Drag and drop file here
Limit 200MB per file • MOV, MP4

Browse files

How do you want the frames to be sifted?

course (I want it fast) medium fine (I can wait)

IMG_0395.MOV

Start picking

Previous Purrfect Picture:

Don't like the photo we picked? No worries! Use the customized criteria selector on the left!

X

☰

MENU

Customize picker

Criteria Selector

What are your criterion for a good picture?

- Original
- Sharp
- Big eyes
- Face at center
- So close to the camera!
- Give me something funny!

MADE BY KATIE HUANG 2021

Welcome to Picture Purrfect!

Customized picker

Don't like the photo we picked? No worries! Use the customized criteria selector on the left!

How about this?

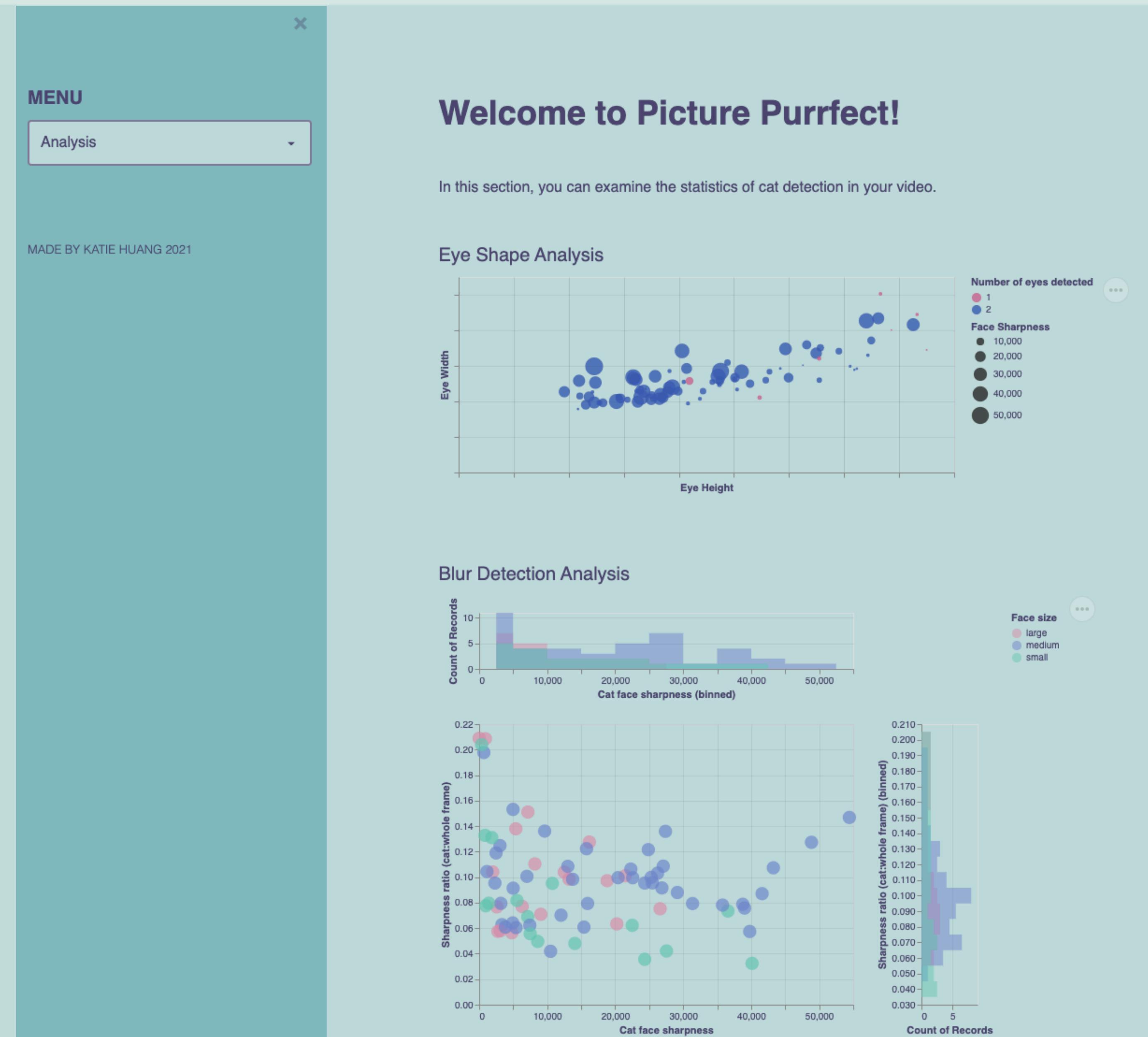
Selected criteria: Give me something funny!

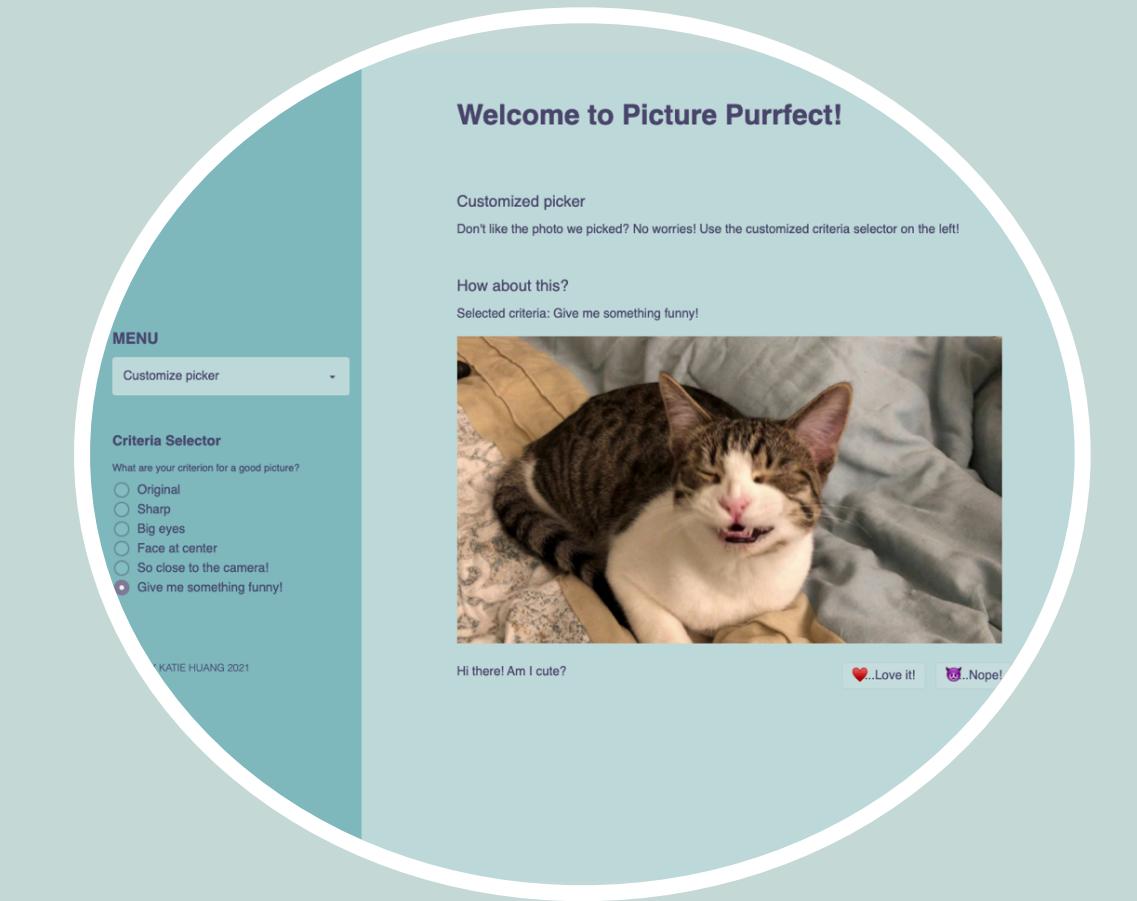


Hi there! Am I cute?

❤️...Love it! ✗...Nope!

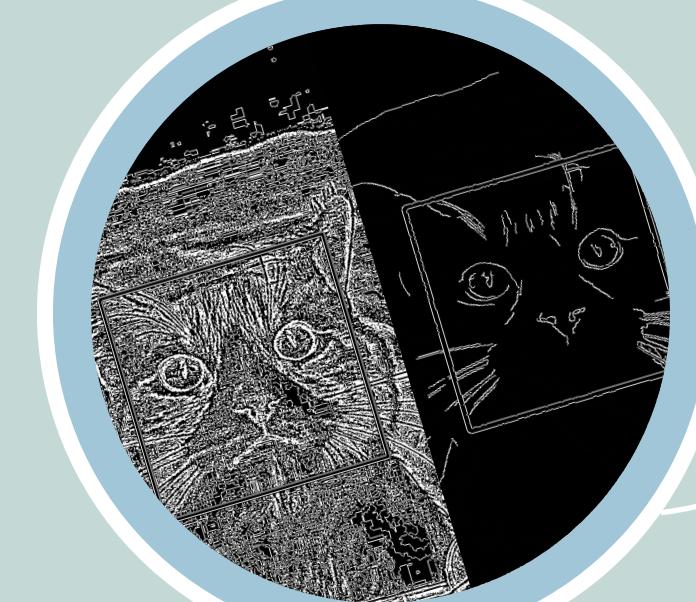
Made with Streamlit





Picture Purrfect App

Cascade
face detection



Neural network
object detection

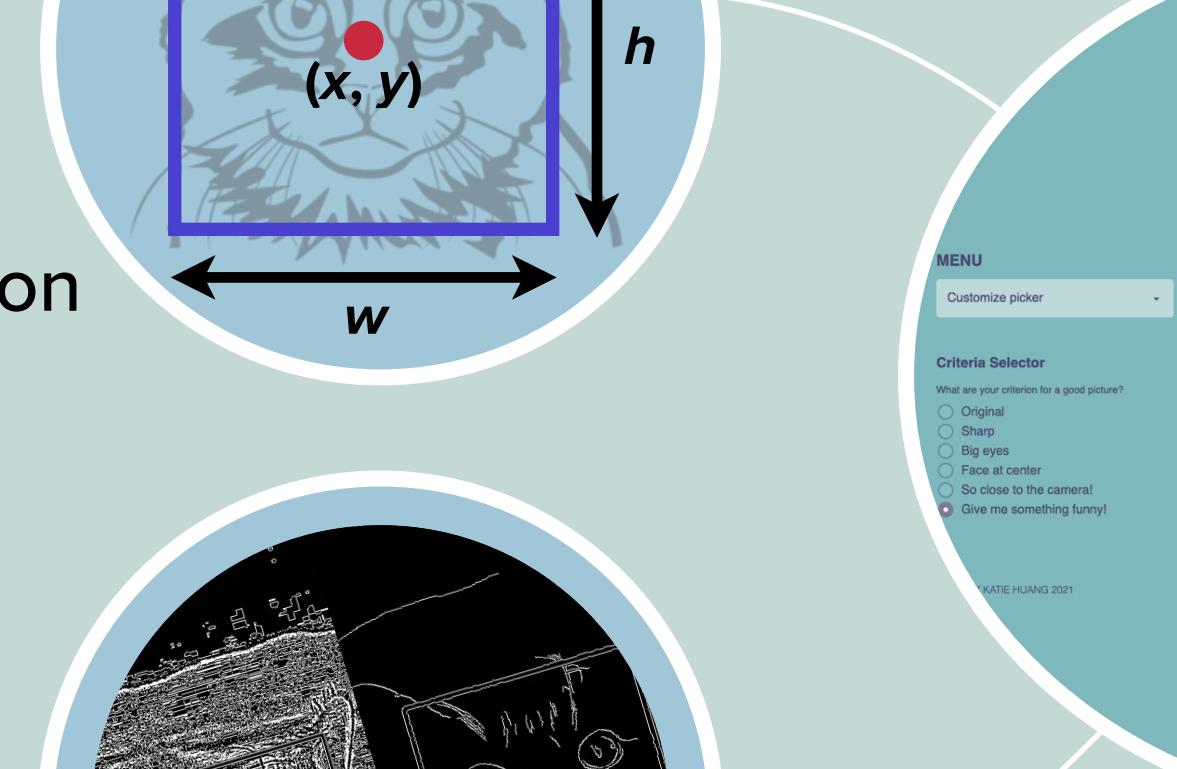
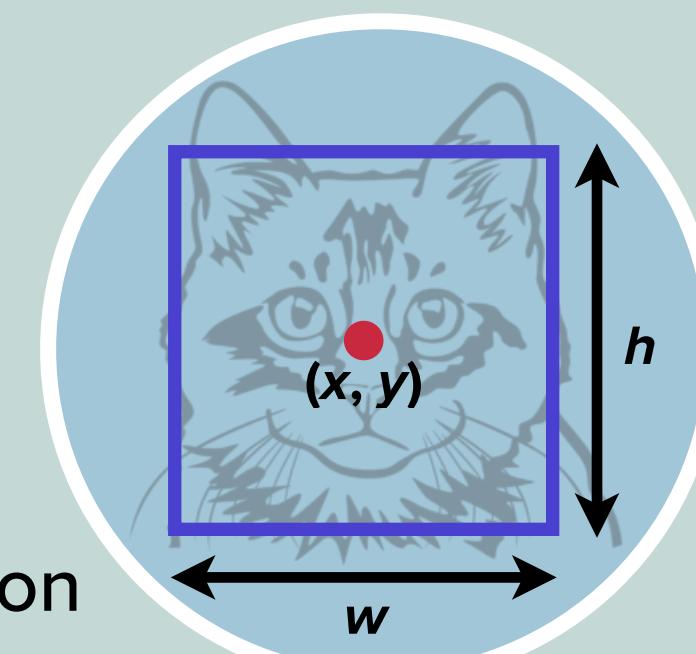
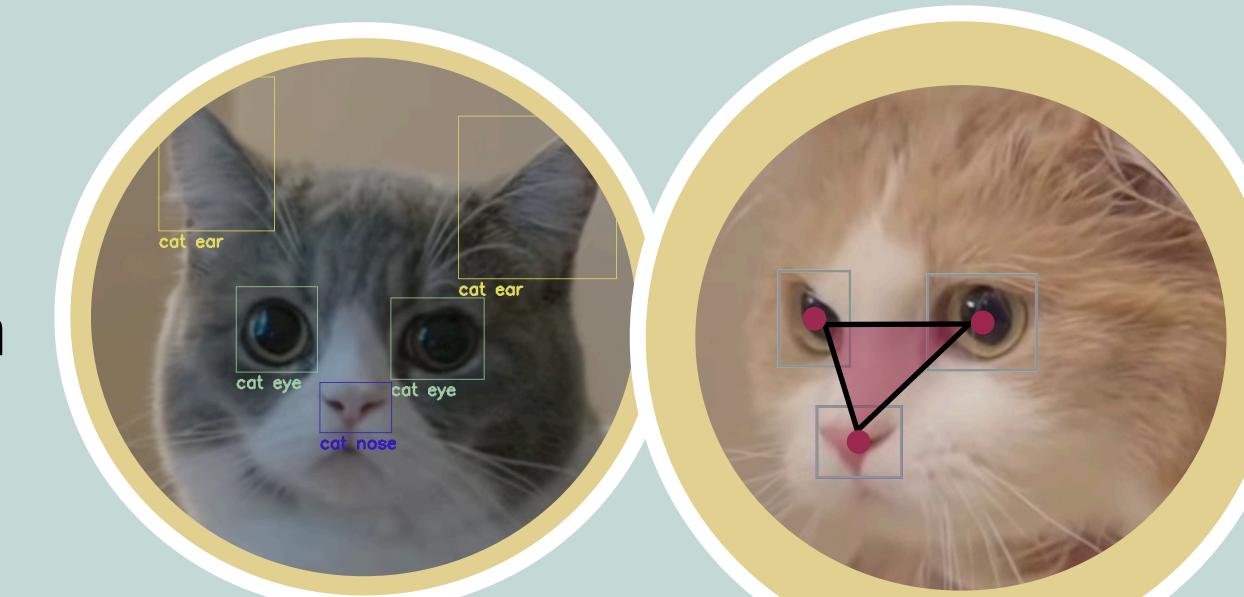
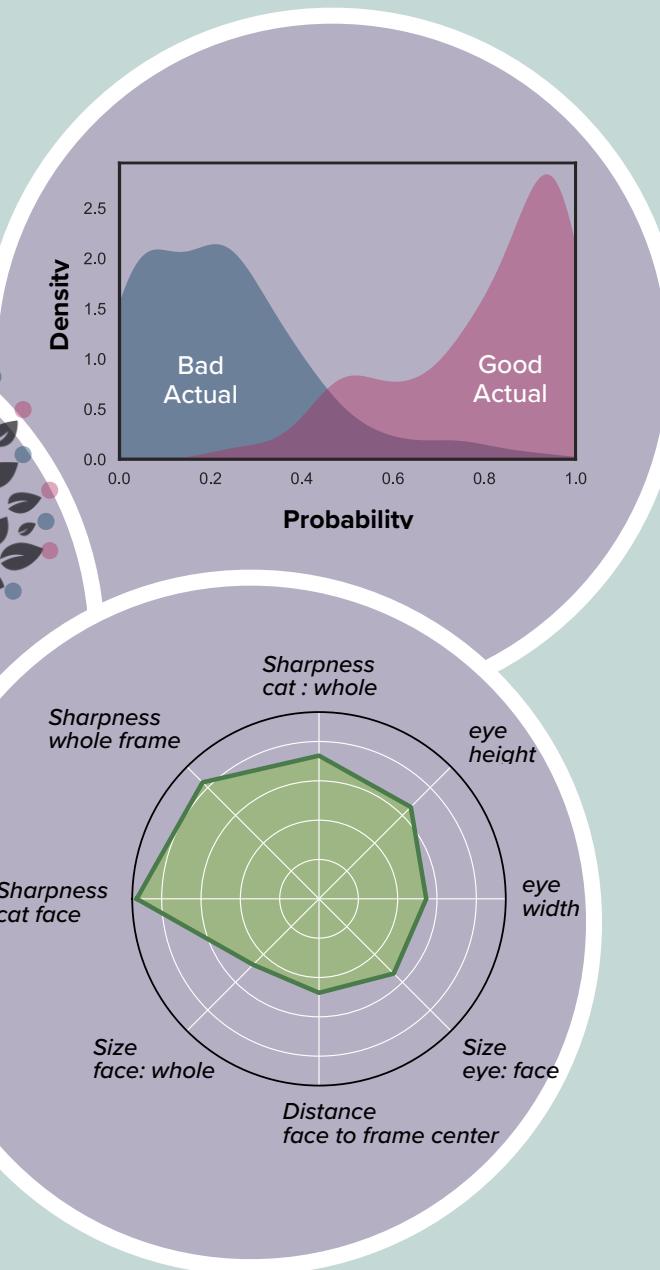


Image processing

Picture Purrfect App

Classification Model

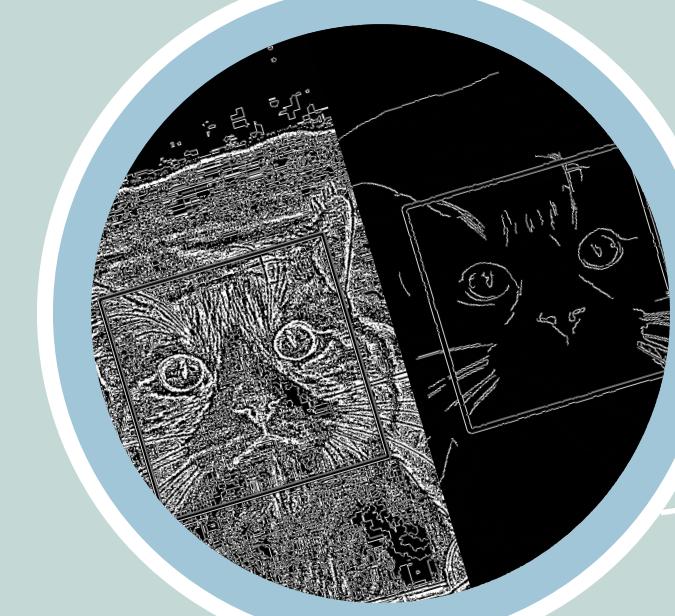
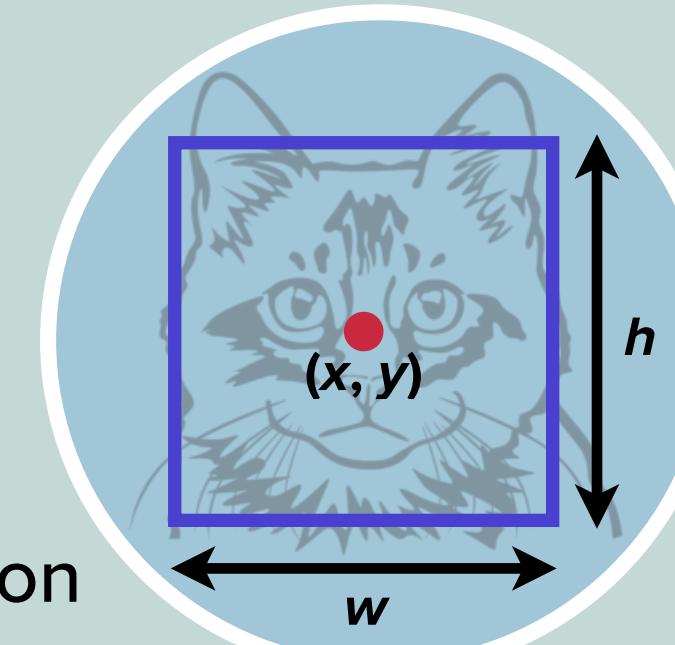


Picture Purrfect App

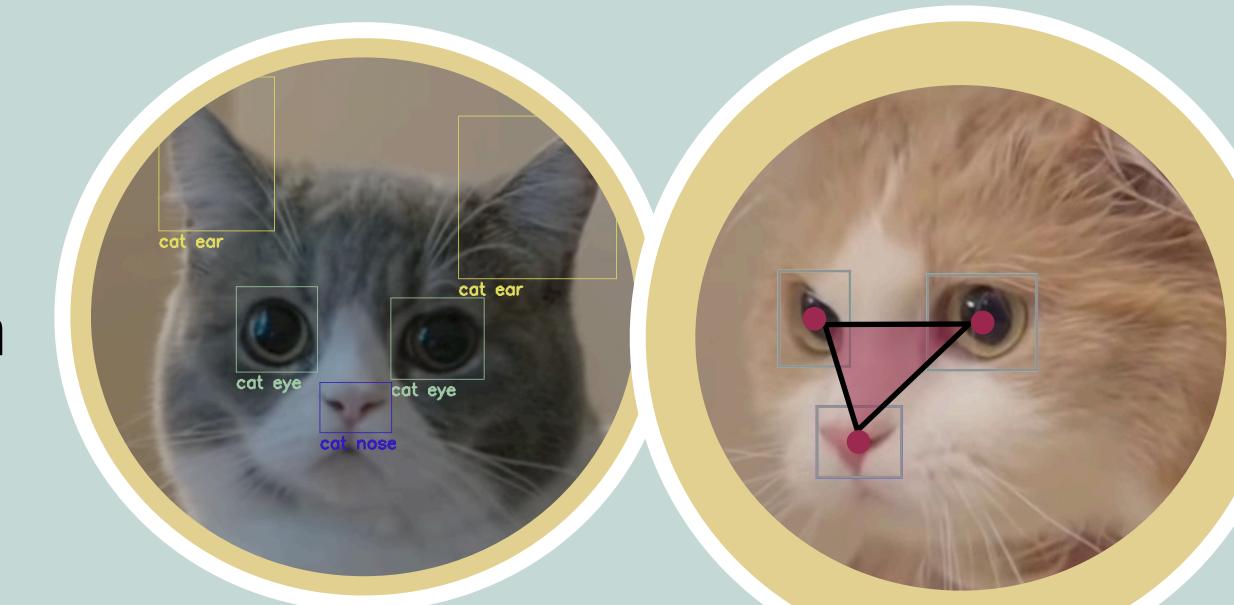
Extension

Dog, human, photo in general

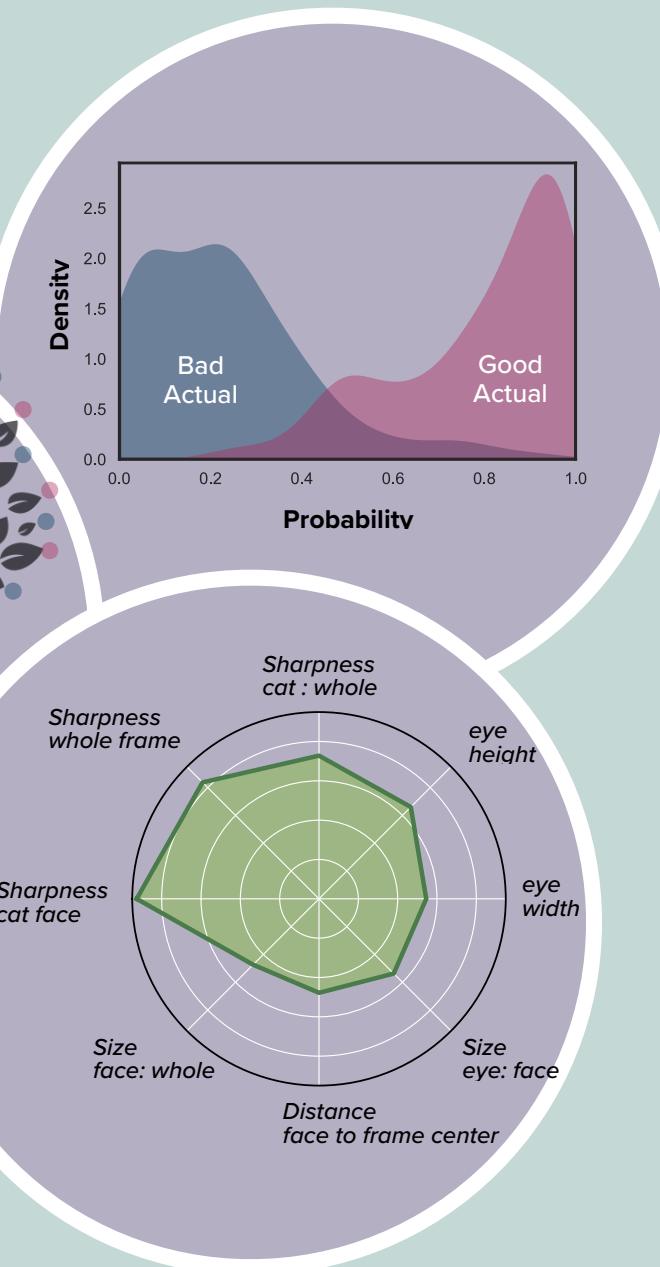
Cascade
face detection



Neural network
object detection



Classification Model



Generalization

Machine learning
└ Computer vision

Neural network
object detection

Cascade
face detection

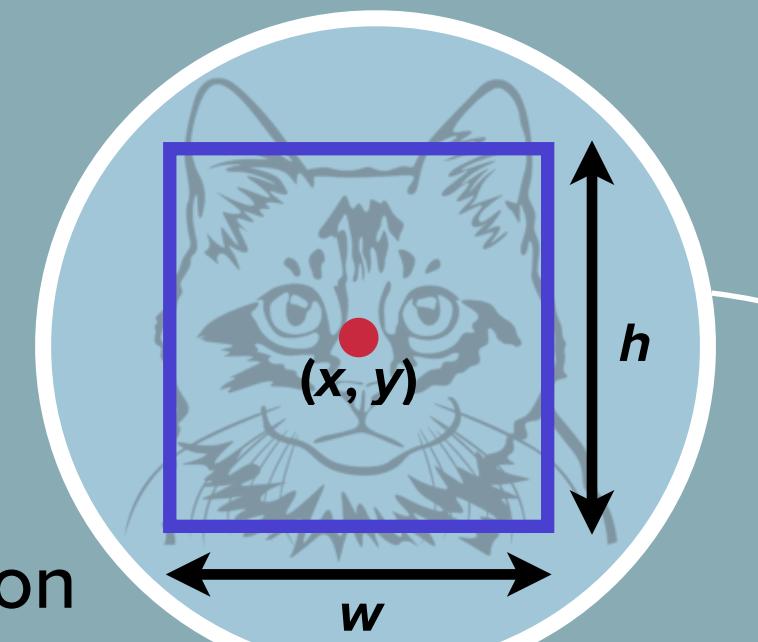
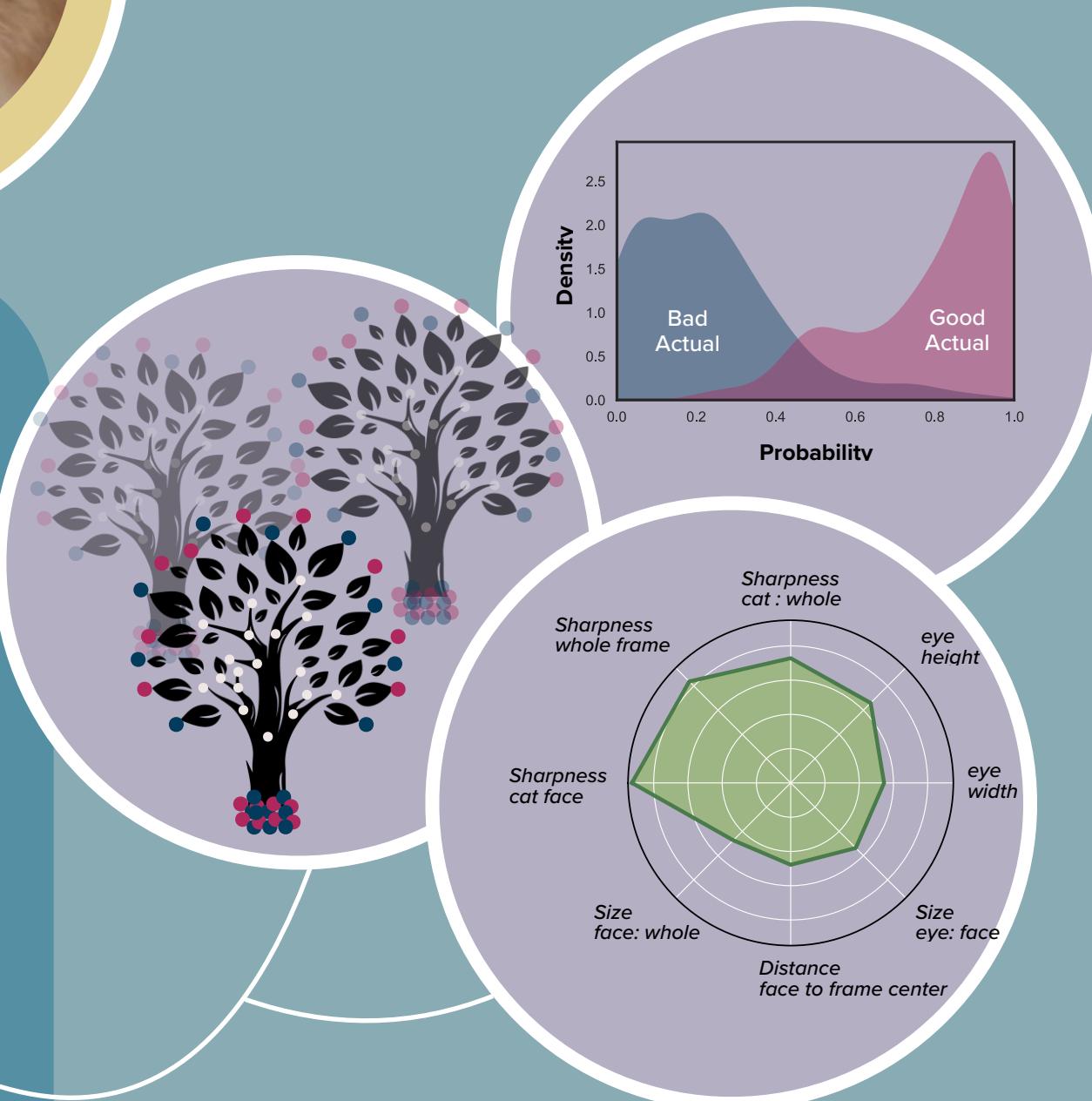
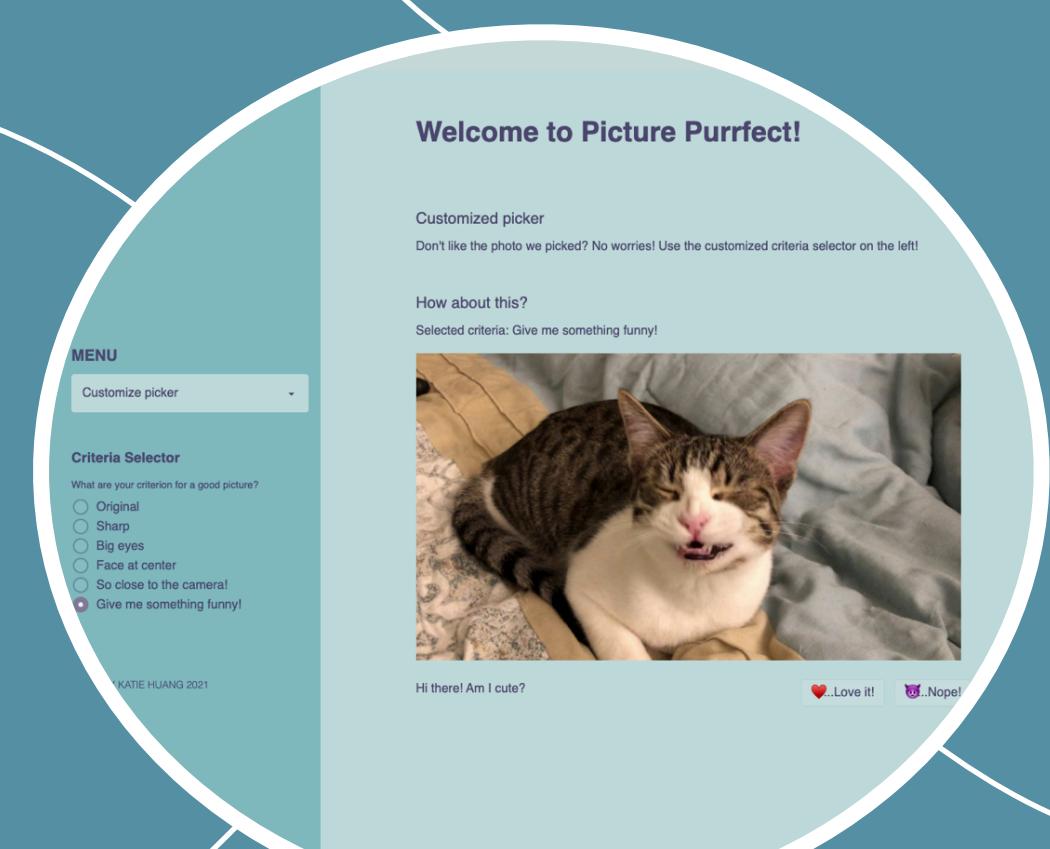
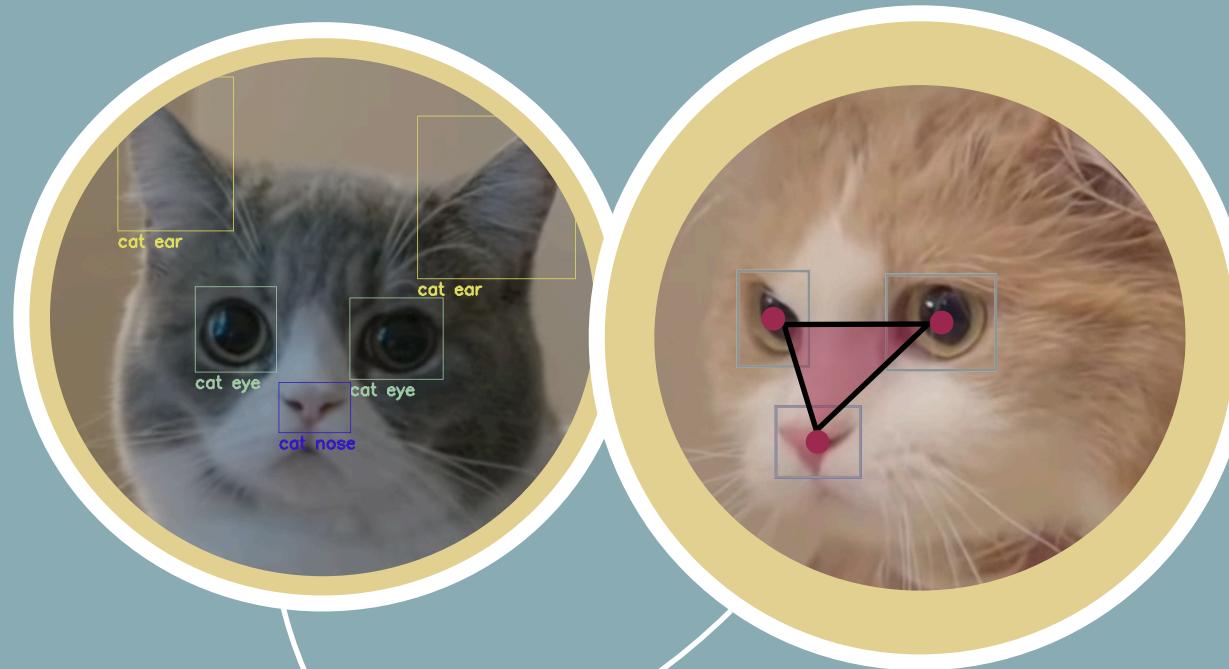


Image processing

Picture Purrfect App

Extension

Dog, human, photo in general



Classification Model

Thank you!

Appendix

[Data](#)[Feature Engineering](#)[Model](#)[App](#)

Comparison of different models

| | AUC | Precision* | Recall* | F1-score* |
|----------------------------|------|------------|---------|-----------|
| Logistic regression | 82.9 | 47 | 86 | 61 |
| Random forest | 83.3 | 72 | 69 | 71 |
| AdaBoost | 77.7 | 68 | 60 | 63 |
| Gradient Boost | 80.9 | 53 | 76 | 63 |
| XGBoost | 82.0 | 62 | 71 | 67 |

Unit: %
* for 'Good' frames

