BirdBrain V. 0.1.1

April 12, 2022

BirdBrain - The Problem

A single Bird Photobooth 2.0, a motion activated camera, producing 9000 4k images per month.

4 RaspberryPI Zero W's with 8 Megapixel cameras that we will be adding to the camera network.

A kickstarter camera that is a year behind delivery schedule, will eventually be added..

The pictures are used by a local bird food company and it would be easy if they knew which birds where in which photos without having to open each file.

Data

Kaggle Dataset

There is a kaggle data set that at the time of download had 325 bird species photo sets.

Images were split into train, validation and test sets.

Images: 224x224 pixels

Processing

Images were tested for being the correct size and uncorrupted.

Images were checked to ensure they were all unique.

Images resized to 480x480 pixels

Modelling

EffcientNet V2

EffcientNetV2 was the 2019 winner of ICML showing high accuracy with smaller models and faster training.

EffcientNetV2B0 - tested
EffcientNetV2S - tested
EffcientNetV2L tested and selected.

EffcientNetV2L

Trained against the dataset and with the initial training had a 71% accuracy.
Images resized to the 480x480 model architecture increasing accuracy to 81%.
Retrained to 83% over all.

Metrics:

Overall Accuracy: 83%
1344/1625

AFRICAN CROWNED CRANE accuracy: 0/5 0%
AFRICAN FIREFINCH accuracy: 5/5 100%
ALBATROSS accuracy: 5/5 100%
ALEXANDRINE PARAKEET accuracy: 4/5 80%
AMERICAN AVOCET accuracy: 5/5 100%
AMERICAN BITTERN accuracy: 5/5 100%
AMERICAN COOT accuracy: 5/5 100%
AMERICAN GOLDFINCH accuracy: 5/5 100%
AMERICAN KESTREL accuracy: 4/5 80%
AMERICAN PIPIT accuracy: 5/5 100%
AMERICAN REDSTART accuracy: 3/5 60%
ANHINGA accuracy: 5/5 100%
ANNA'S HUMMINGBIRD accuracy: 0/5 0%
ANTBIRD accuracy: 2/5 40%
ARARIPE MANAKIN accuracy: 5/5 100%
ASIAN CRESTED IBIS accuracy: 3/5 60%
BALD EAGLE accuracy: 5/5 100%
BALD IBIS accuracy: 0/5 0%
BALI STARLING accuracy: 5/5 100%
BALTIMORE ORIOLE accuracy: 5/5 100%
BANANAQUIT accuracy: 5/5 100%
BANDED BROADBILL accuracy: 5/5 100%
BANDED PITA accuracy: 5/5 100%
BAR-TAILED GODWIT accuracy: 5/5 100%
BARN OWL accuracy: 5/5 100%
BARN SWALLOW accuracy: 5/5 100%
BARRED PUFFBIRD accuracy: 3/5 60%
BAY-BREASTED WARBLER accuracy: 4/5 80%
BEARDED BARBET accuracy: 4/5 80%
BEARDED BELLBIRD accuracy: 5/5 100%
BEARDED REEDLING accuracy: 5/5 100%
BELTED KINGFISHER accuracy: 2/5 40%
BIRD OF PARADISE accuracy: 5/5 100%
BLACK & YELLOW bROADBILL accuracy: 5/5 100%
BLACK BAZA accuracy: 4/5 80%
BLACK FRANCOLIN accuracy: 4/5 80%
BLACK SKIMMER accuracy: 5/5 100%
BLACK SWAN accuracy: 5/5 100%
BLACK TAIL CRAKE accuracy: 5/5 100%
BLACK THROATED BUSHTIT accuracy: 5/5 100%

API

To bring a project to life, you need to expose it to the world.

Using FastAPI in a micro service architecture exposing:

POST: / - Taking in the image and returning the JSON data of what was classified.

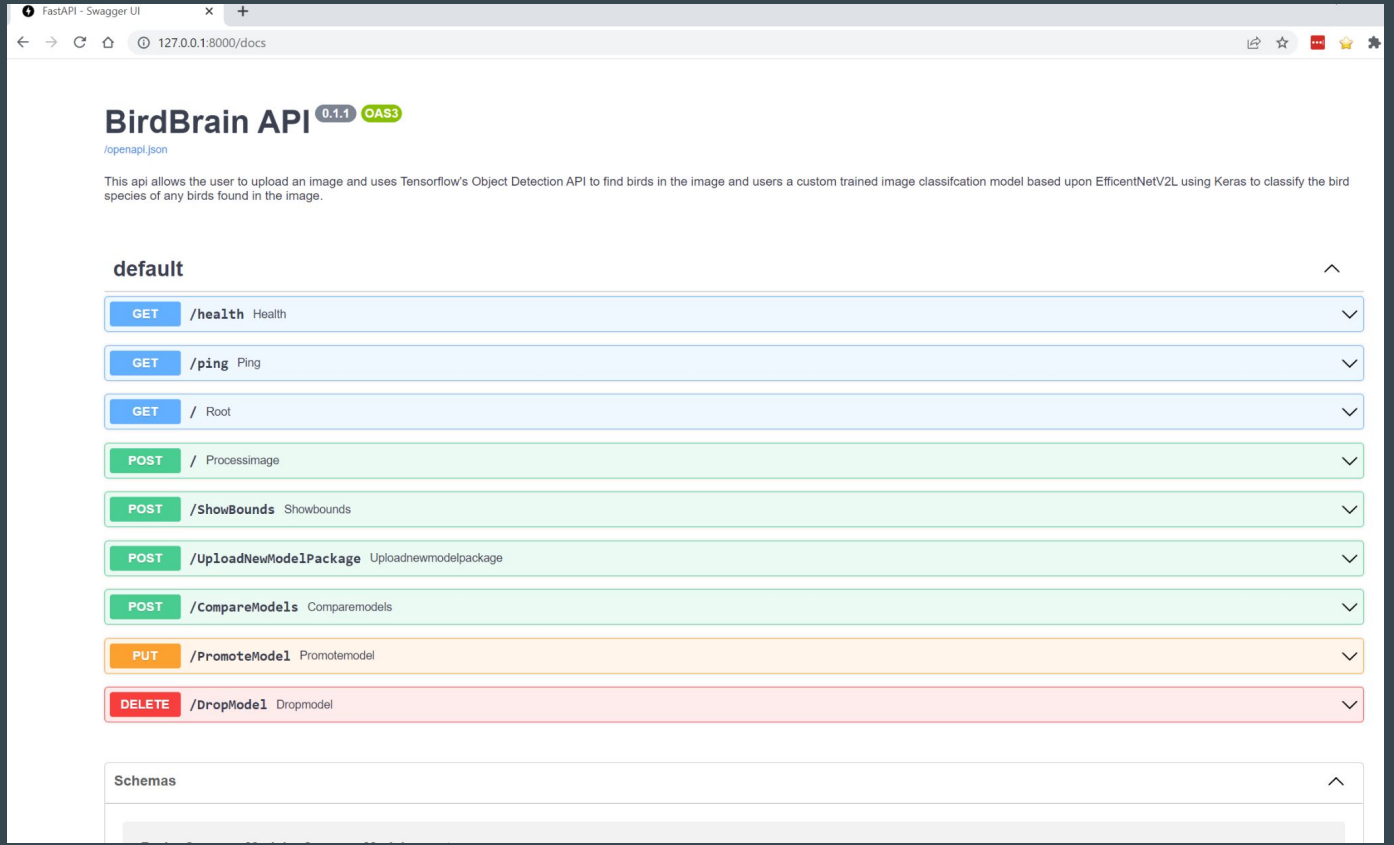
POST: /ShowBounds - Taking in the image and returning the image with bounding boxes.

POST: /UploadNewModel - Taking a model package to do A/B testing.

POST: /CompareModel - Taking in the image and returning the JSON data from both the Production model and the newly Staged model.

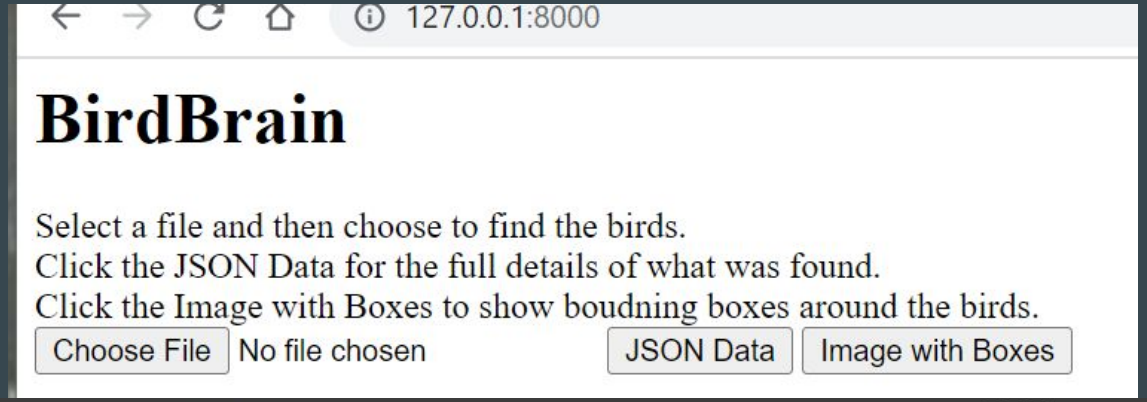
API - Read the docs

One of the really nice things about FastAPI is the fact it automatically provides a test harness through OpenAPI/Swagger.



API - Test Harness

One simple thing that you can do to ensure your efforts are useful is to provide an even simpler test harness for the main use case of your models.



File Edit Selection View Go Run Terminal Help — server.py - API - Visual Studio Code

EXPLORER

API
- __pycache__
- models
- BirdBrain.py 4
- requirements.txt
- server.py 1

OUTLINE
TIMELINE

BirdBrain.py 4 | server.py 1

server.py > ...

```
59      """Keep alive"""
60      return "pong"
61
62  @app.get("/")
63  async def root():
64      return HTMLResponse(status_code=200, content="""
65      <html><head><title>BirdBrain V. 0.1.1</title></head><body>
66          <h1>BirdBrain</h1>
67          <div>Select a file and then choose to find the birds.<br>
68          Click the JSON Data for the full details of what was found.<br>
69          Click the Image with Boxes to show boudning boxes around the birds.<br></div>
70          <form method=post enctype='multipart/form-data'>
71              <input type=file name=image>
72              <input type=submit value='JSON Data'>
73              <input type=button value='Image with Boxes' onclick="javascript: this.form.action='/ShowBounds'; this.form.submit()">
74          </form>
75      </body></html>
76      """)
77
78  @app.post("/")
```

main* 0↓ 1↑ ⊗ 0 ⚠ 5 — C K, 5 days ago Ln 1, Col 1 Spaces: 4 UTF-8 CRLF Python 3.10.4 64-bit

BirdBrain Roadmap

Image Augmentation

The current dataset had no significant image augmentation. Flipping the the images as well as rotating should improve accuracy and will be tested next.

Images will be better bound to reduce background noise:
While testing the object detection model it was shown that some of the images were could be isolated better to the birds

Adding More Data

Cornell's Ornithology Labs released the NABirds dataset.

This dataset contains 550 bird species for just north america but needs to be cleaned and curated to the current format.

Kaggle Bird Species dataset has also been increased to 400 bird species.

Thank you

The project can be found at: https://github.com/tinman-chad/BirdBrain

I can be found at: https://www.linkedin.com/in/chadkprofile/

You can contact the project at: BirdBrain@cfk.me