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**** Assignment submission by Arjun Shrivatsan

**** EAI 6010 - Assignment No: Module 5 - Face Mask Detection Microservice

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About

This microservice detects whether a person is wearing a face mask using a trained deep learning model based on **InceptionV3** architecture. It was developed as part of **EAI 6010 - Applications of AI** course.

The API accepts an uploaded image and returns whether the subject is **Wearing a Mask**, **Not Wearing a Mask**, or **Wearing a Mask Incorrectly** along with confidence scores.

What does this assignment do?

- Trains a deep learning model using annotated XML image data
- Builds a REST API using FastAPI
- Allows real-time prediction of face mask usage from uploaded images
- Supports deployment via Docker and Render

How to Run the App

Run via Swagger (Render Deployment)

👉 URL: https://facial-mask-detection.onrender.com/docs

1. Go to the Swagger UI URL above
2. Click `/predict` → "Try it out"
3. Upload an image (JPG/PNG) → Execute

4. View Prediction and Confidence

Run Locally via Docker

```
git clone https://github.com/arcsphere/facial-mask-detection.git
cd facial-mask-detection

# Build Docker image
docker build -t face-mask-api .

# Run the container
docker run -p 8000:8000 face-mask-api
```

Access API at: http://localhost:8000/docs

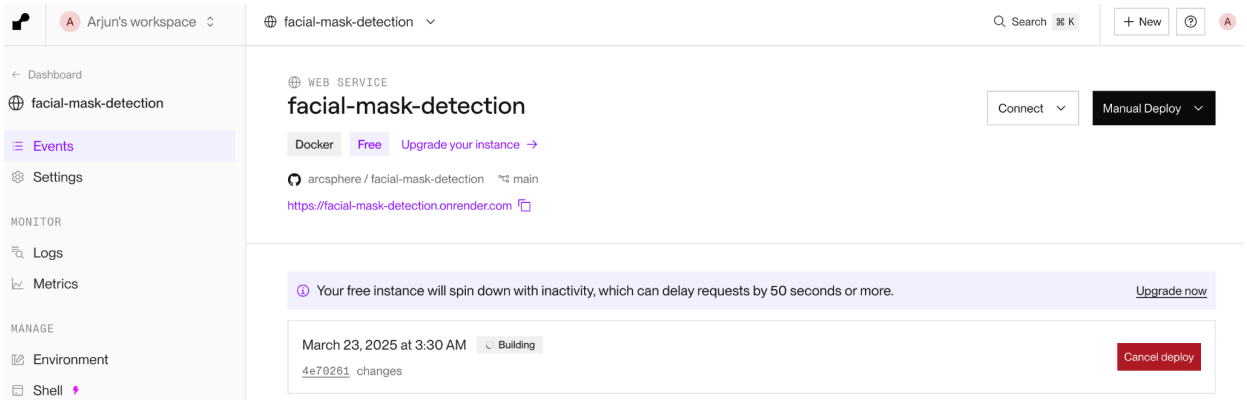
Run via cURL

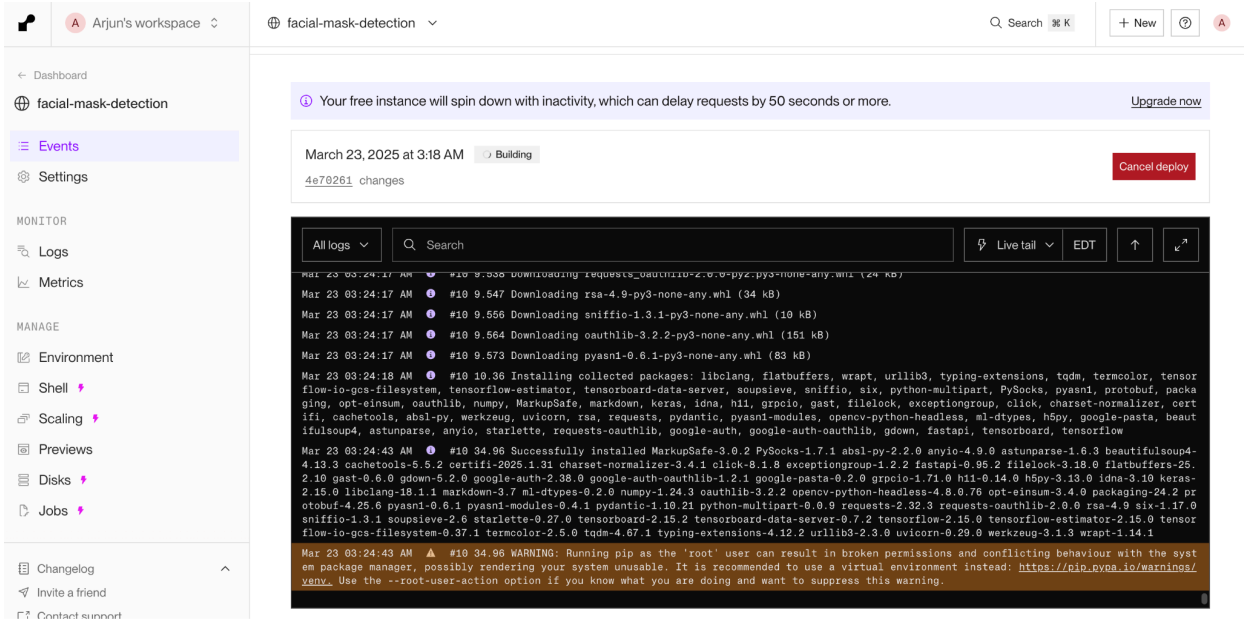
```
curl -X 'POST' \
  'http://localhost:8000/predict' \
  -F 'file=@your-image.jpg' \
  -H 'accept: application/json' \
  -H 'Content-Type: multipart/form-data'
```

⚙️ Installation Instructions (Local)

```
# Clone repo
git clone https://github.com/arcsphere/facial-mask-detection.git
cd facial-mask-detection

# Create a virtual environment
python -m venv maskenv
source maskenv/bin/activate

# Install dependencies
pip install -r requirements.txt

# Run FastAPI locally
uvicorn app.app:app --reload
```

Deployment at onrender.com


A Arjun's workspace
facial-mask-detection
Search ⌘ K
+ New
A
Dashboard
facial-mask-detection
Events
Settings
MONITOR
Logs
Metrics
MANAGE
Environment
Shell
WEB SERVICE
facial-mask-detection
Connect
Manual Deploy
Docker
Free
Upgrade your instance →
arcsphere / facial-mask-detection
main
https://facial-mask-detection.onrender.com
Your free instance will spin down with inactivity, which can delay requests by 50 seconds or more.
Upgrade now
March 23, 2025 at 3:30 AM
Building
4e70261 changes
Cancel deploy


Arjun's workspace
facial-mask-detection
Search ⌘ K
New
Dashboard
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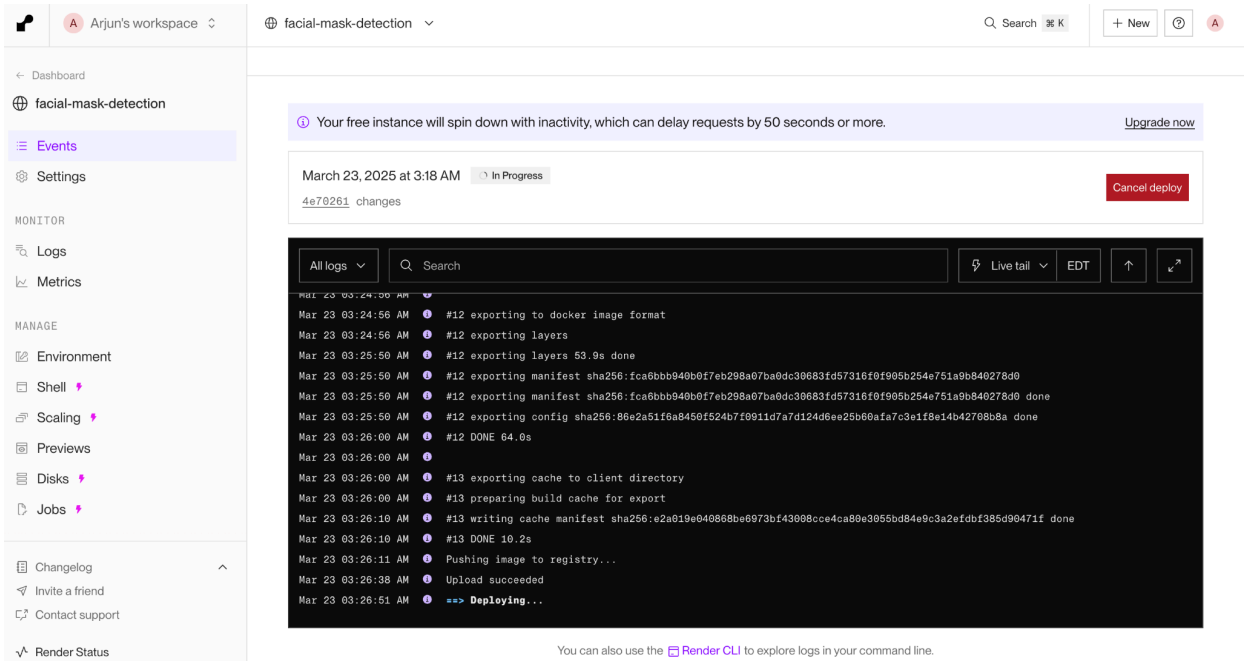
Shell
Scaling
Previews
Disks
Jobs
Changelog
Invite a friend
Contact support
Your free instance will spin down with inactivity, which can delay requests by 50 seconds or more.
Upgrade now
March 23, 2025 at 3:18 AM
Building
4e70261 changes
Cancel deploy
All logs
Search
Live tail
EDT
Mar 23 03:24:17 AM #10 9.547 Downloading rsa-4.9-py3-none-any.whl (34 kB)
Mar 23 03:24:17 AM #10 9.556 Downloading sniffio-1.3.1-py3-none-any.whl (10 kB)
Mar 23 03:24:17 AM #10 9.564 Downloading oauthlib-3.2.2-py3-none-any.whl (151 kB)
Mar 23 03:24:17 AM #10 9.573 Downloading pyasn1-0.6.1-py3-none-any.whl (83 kB)
Mar 23 03:24:18 AM #10 10.36 Installing collected packages: libclang, flatbuffers, wrapt, urllib3, typing-extensions, tqdm, termcolor, tensorflow-io-gcs-filesystem, tensorflow-estimator, tensorboard-data-server, soupsieve, sniffio, six, python-multipart, PySocks, pyasn1, protobuf, packaging, opt-einsum, oauthlib, numpy, MarkupSafe, markdown, keras, idna, h11, grpcio, gast, filelock, exceptiongroup, click, charset-normalizer, certifi, cachetools, absl-py, werkzeug, uvicorn, rsa, requests, pydantic, pyasn1-modules, opencv-python-headless, ml-dtypes, h5py, google-pasta, beautifulsoup4, astunparse, anyio, starlette, requests-oauthlib, google-auth, google-auth-oauthlib, gdown, fastapi, tensorboard, tensorflow
Mar 23 03:24:43 AM #10 34.96 Successfully installed MarkupSafe-3.0.2 PySocks-1.7.1 absl-py-2.2.0 anyio-4.9.0 astunparse-1.6.3 beautifulsoup4-4.13.3 cachetools-5.5.2 certifi-2025.1.31 charset-normalizer-3.4.1 click-8.1.8 exceptiongroup-1.2.2 fastapi-0.95.2 filelock-3.18.0 flatbuffers-25.2.10 gast-0.6.0 gdown-5.2.0 google-auth-2.38.0 google-auth-oauthlib-1.2.1 google-pasta-0.2.0 grpcio-1.71.0 h11-0.14.0 h5py-3.13.0 idna-3.10 keras-2.15.0 libclang-18.1.1 markdown-3.7 ml-dtypes-0.2.0 numpy-1.24.3 oauthlib-3.2.2 opencv-python-headless-4.8.0.76 opt-einsum-3.4.0 packaging-24.2 protobuf-4.25.6 pyasn1-0.6.1 pyasn1-modules-0.4.1 pydantic-1.10.21 python-multipart-0.0.9 requests-2.32.3 requests-oauthlib-2.0.0 rsa-4.9 six-1.17.0 sniffio-1.3.1 soupsieve-2.6 starlette-0.27.0 tensorboard-2.15.2 tensorboard-data-server-0.7.2 tensorflow-2.15.0 tensorflow-estimator-2.15.0 tensorflow-io-gcs-filesystem-0.37.1 termcolor-2.5.0 tqdm-4.67.1 typing-extensions-4.12.2 urllib3-2.3.0 uvicorn-0.29.0 werkzeug-3.1.3 wrapt-1.14.1
Mar 23 03:24:43 AM #10 34.96 WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager, possibly rendering your system unusable. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv. Use the --root-user-action option if you know what you are doing and want to suppress this warning.


Arjun's workspace
facial-mask-detection
Search ⌘ K
New
Dashboard
facial-mask-detection
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MONITOR
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Environment
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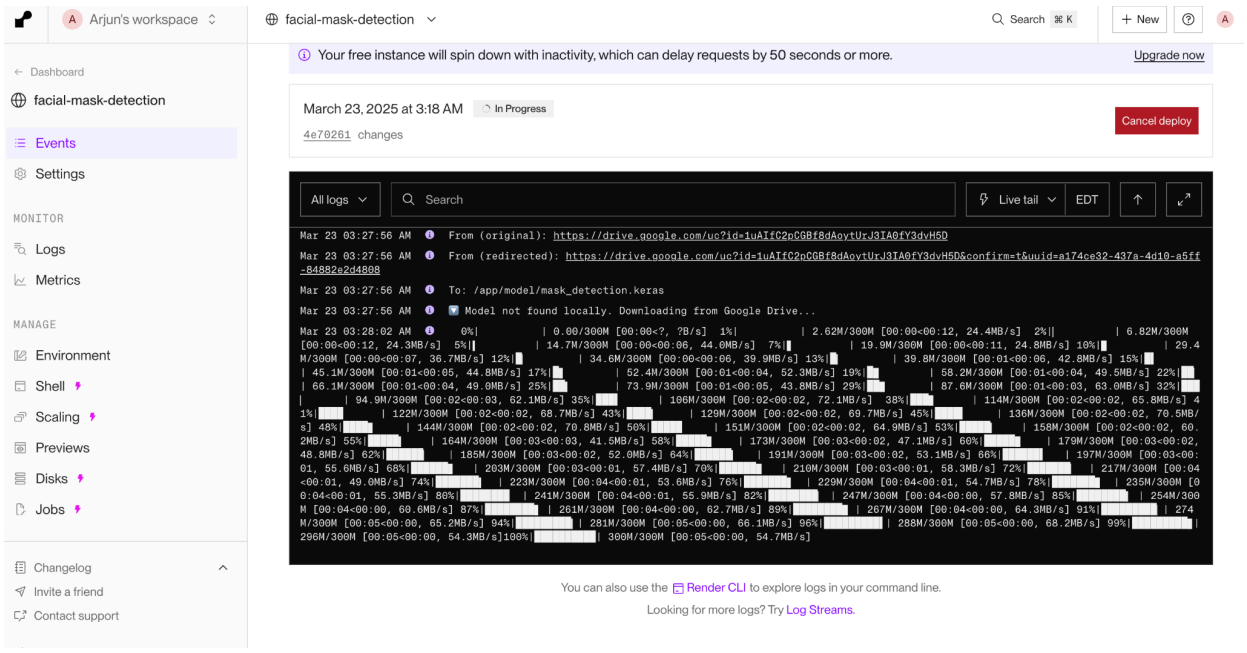
Previews
Disks
Jobs
Changelog
Invite a friend
Contact support
Render Status
Your free instance will spin down with inactivity, which can delay requests by 50 seconds or more.
Upgrade now
March 23, 2025 at 3:18 AM
In Progress
4e70261 changes
Cancel deploy
All logs
Search
Live tail
EDT
Mar 23 03:24:56 AM #12 exporting to docker image format
Mar 23 03:24:56 AM #12 exporting layers
Mar 23 03:25:50 AM #12 exporting layers 53.9s done
Mar 23 03:25:50 AM #12 exporting manifest sha256:fca6bbb940b0f7eb298a07ba0dc30683fd57316f0f905b254e751a9b840278d0
Mar 23 03:25:50 AM #12 exporting manifest sha256:fca6bbb940b0f7eb298a07ba0dc30683fd57316f0f905b254e751a9b840278d0 done
Mar 23 03:25:50 AM #12 exporting config sha256:86e2a51f6a8450f524b7f0911d7a7d124d6ee25b60afa7c3e1f8e14b42708b8a done
Mar 23 03:26:00 AM #12 DONE 64.0s
Mar 23 03:26:00 AM #13 exporting cache to client directory
Mar 23 03:26:00 AM #13 preparing build cache for export
Mar 23 03:26:10 AM #13 writing cache manifest sha256:e2a019e040868be6973bf43008cce4ca80e3055bd84e9c3a2efdbf385d90471f done
Mar 23 03:26:10 AM #13 DONE 10.2s
Mar 23 03:26:11 AM Pushing image to registry...
Mar 23 03:26:38 AM Upload succeeded
Mar 23 03:26:51 AM ==> Deploying...
You can also use the Render CLI to explore logs in your command line.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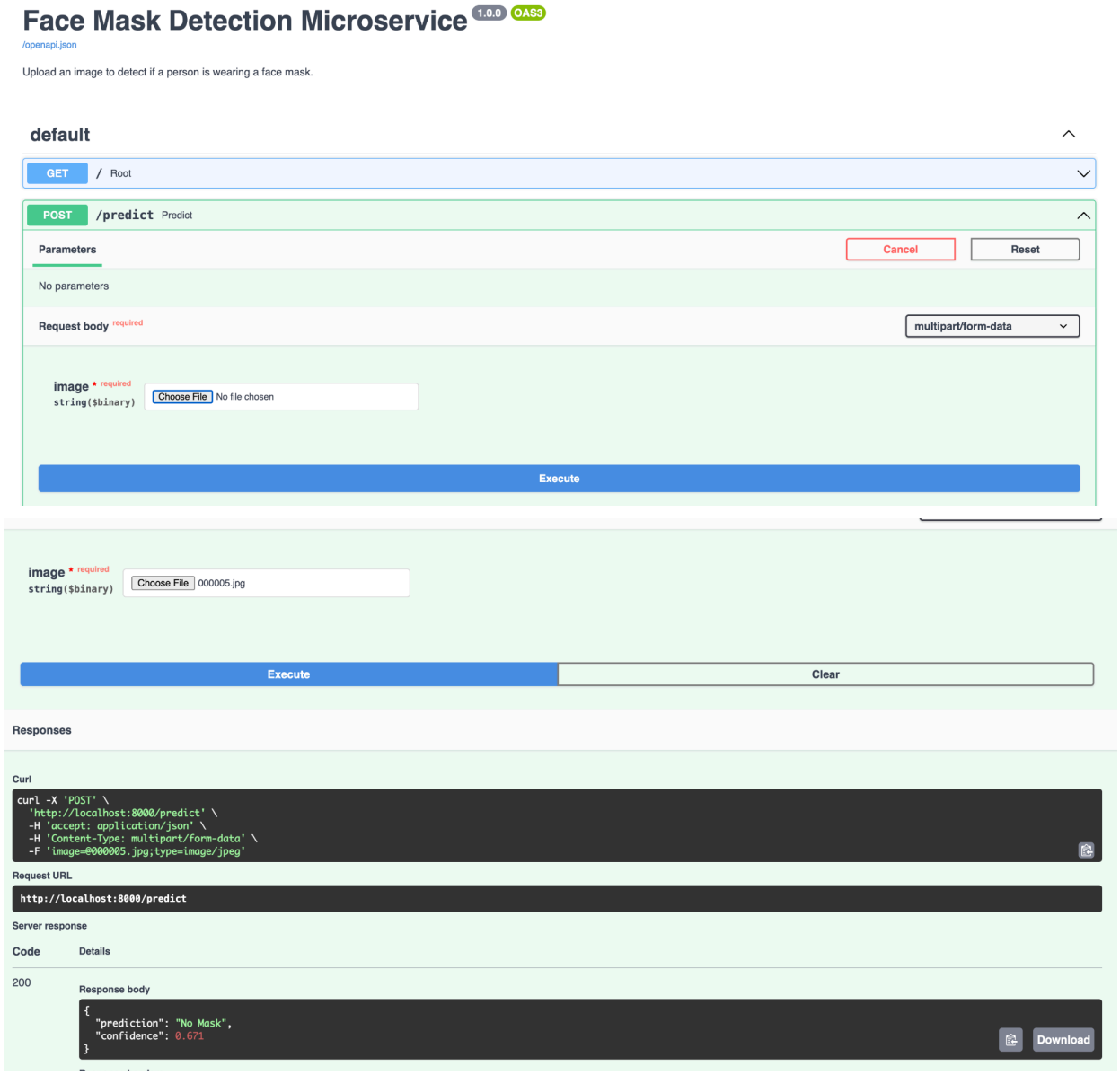
Your free instance will spin down with inactivity, which can delay requests by 50 seconds or more.
Upgrade now
March 23, 2025 at 3:18 AM
In Progress
4e70261 changes
Cancel deploy
All logs
Search
Live tail
EDT
Mar 23 03:27:56 AM From (original): https://drive.google.com/uc?id=1uAIfC2pCGBf8dAoytUrJ3IA0fY3dvH5D
Mar 23 03:27:56 AM From (redirected): https://drive.google.com/uc?id=1uAIfC2pCGBf8dAoytUrJ3IA0fY3dvH5D&confirm=t&uuid=a174ce32-437a-4d10-a5ff-84882e2d4808
Mar 23 03:27:56 AM To: /app/model/mask_detection.keras
Mar 23 03:27:56 AM Model not found locally. Downloading from Google Drive...
Mar 23 03:28:02 AM 0%| | 0.00/300M [00:00<?, ?B/s] 1%| | 2.62M/300M [00:00<00:12, 24.4MB/s] 2%| | 6.82M/300M [00:00<00:12, 24.3MB/s] 5%| | 14.7M/300M [00:00<00:06, 44.0MB/s] 7%| | 19.9M/300M [00:00<00:11, 24.8MB/s] 10%| | 29.4M/300M [00:00<00:07, 36.7MB/s] 12%| | 34.6M/300M [00:00<00:06, 39.9MB/s] 13%| | 39.8M/300M [00:01<00:06, 42.8MB/s] 15%| | 45.1M/300M [00:01<00:05, 44.8MB/s] 17%| | 52.4M/300M [00:01<00:04, 52.3MB/s] 19%| | 58.2M/300M [00:01<00:04, 49.5MB/s] 22%| | 66.1M/300M [00:01<00:04, 49.0MB/s] 25%| | 73.9M/300M [00:01<00:05, 43.8MB/s] 29%| | 87.6M/300M [00:01<00:03, 63.0MB/s] 32%| | 94.9M/300M [00:02<00:03, 62.1MB/s] 35%| | 106M/300M [00:02<00:02, 72.1MB/s] 38%| | 114M/300M [00:02<00:02, 65.8MB/s] 41%| | 122M/300M [00:02<00:02, 68.7MB/s] 43%| | 129M/300M [00:02<00:02, 69.7MB/s] 45%| | 136M/300M [00:02<00:02, 70.5MB/s] 48%| | 144M/300M [00:02<00:02, 70.8MB/s] 50%| | 151M/300M [00:02<00:02, 64.9MB/s] 53%| | 158M/300M [00:02<00:02, 60.2MB/s] 55%| | 164M/300M [00:03<00:03, 41.5MB/s] 58%| | 173M/300M [00:03<00:02, 47.1MB/s] 60%| | 179M/300M [00:03<00:02, 48.8MB/s] 62%| | 185M/300M [00:03<00:02, 52.0MB/s] 64%| | 191M/300M [00:03<00:02, 53.1MB/s] 66%| | 197M/300M [00:03<00:01, 55.6MB/s] 68%| | 203M/300M [00:03<00:01, 57.4MB/s] 70%| | 210M/300M [00:03<00:01, 58.3MB/s] 72%| | 217M/300M [00:04<00:01, 49.0MB/s] 74%| | 223M/300M [00:04<00:01, 53.6MB/s] 76%| | 229M/300M [00:04<00:01, 54.7MB/s] 78%| | 235M/300M [00:04<00:01, 55.3MB/s] 80%| | 241M/300M [00:04<00:01, 55.9MB/s] 82%| | 247M/300M [00:04<00:00, 57.8MB/s] 85%| | 254M/300M [00:04<00:00, 60.6MB/s] 87%| | 261M/300M [00:04<00:00, 62.7MB/s] 89%| | 267M/300M [00:04<00:00, 64.3MB/s] 91%| | 274M/300M [00:05<00:00, 65.2MB/s] 94%| | 281M/300M [00:05<00:00, 66.1MB/s] 96%| | 288M/300M [00:05<00:00, 68.2MB/s] 99%| | 296M/300M [00:05<00:00, 54.3MB/s]100%| | 300M/300M [00:05<00:00, 54.7MB/s]
You can also use the Render CLI to explore logs in your command line.
Looking for more logs? Try Log Streams.

Usage



Tech Stack

- **TensorFlow 2.15 / Keras** – Model Training
- **InceptionV3** – Base CNN architecture
- **OpenCV** – Image processing
- **FastAPI** – API development
- **Docker** – Containerization
- **Render** – Cloud deployment

- **Swagger / OpenAPI** – API docs

Directory Structure

```
.
├── app/
│   └── app.py
├── model/
│   └── mask_detection.keras (downloaded via gdown in utils)
├── utils.py
├── requirements.txt
├── Dockerfile
└── README.md
```

Resources

- FastAPI Docs
- Keras Applications
- TensorFlow InceptionV3
- Google Drive File Download using gdown

Model Download Link is included in `utils.py` to automatically fetch the model from Google Drive if it's not found locally.

Final Notes

- All local runs, Docker runs, and Render deployment are functional.
- Model file is **excluded from GitHub repo** due to size.
- Render fetches model at runtime from Drive using `gdown`.
- Swagger provides easy-to-use UI for testing and demonstrating the microservice.

Submitted by: Arjun Shrivatsan (002028814)
Course: EAI 6010 – Applications of AI
Module: 5 – Face Mask Detection