GET and POST requests for AI

DEPLOYING AI INTO PRODUCTION WITH FASTAPI

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Our instructor

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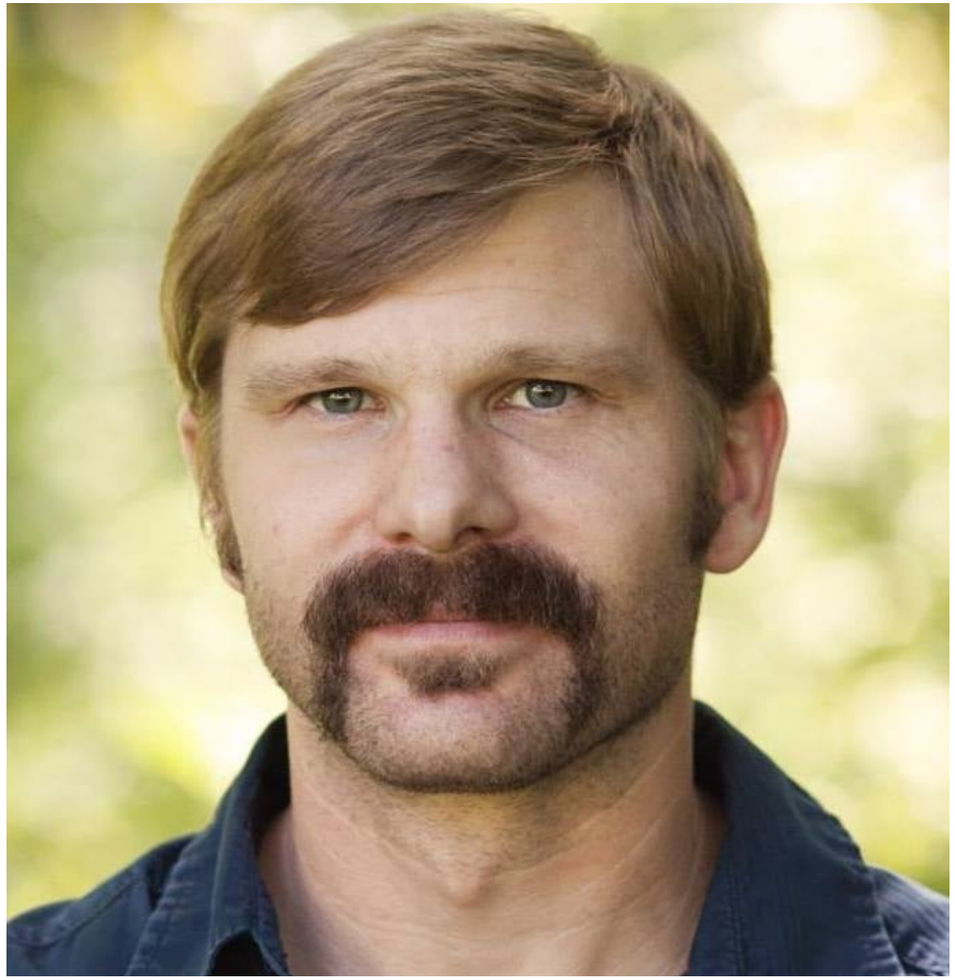


- Software and Data Engineering Leader
- Enterprise Data Manager at Inari
- Using FastAPI for ML since 2019

Course overview

- FastAPI fundamentals
- Request handling and integration
- Input validation and security
- Create and maintain production-ready APIs

Before we start

✓ Basic python: functions, classes, modules, data structures

✓ HTTP & REST API concepts

✓ Using the FastAPI framework

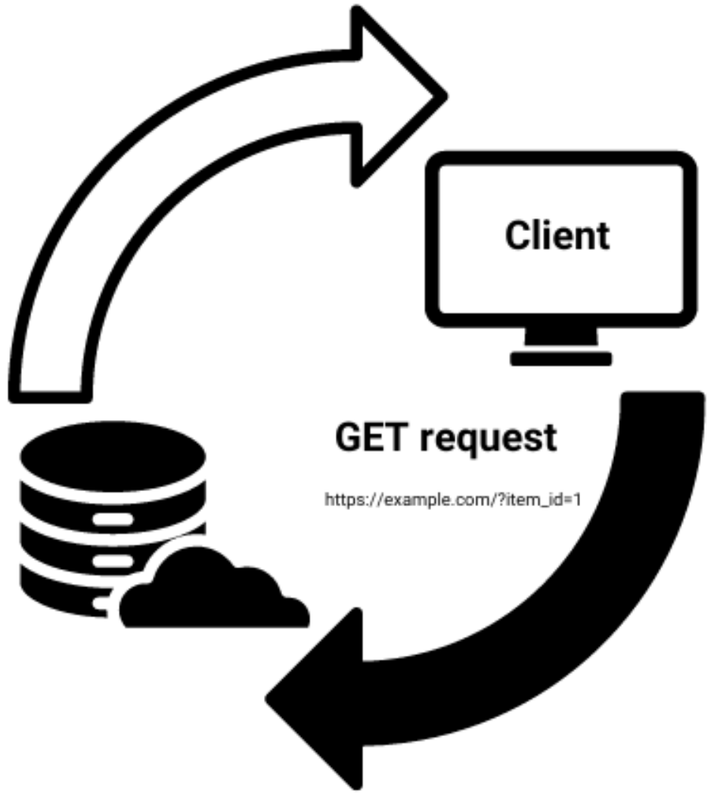
- Handling GET and POST requests
- Using Pydantic models

✓ Machine learning basics: create, save, predict

GET requests explained

- Used to retrieve data
- Path parameter - information in URL
- Doesn't change server state

```
GET https://example.com/?item_id=1
```



Implementing GET with path parameters

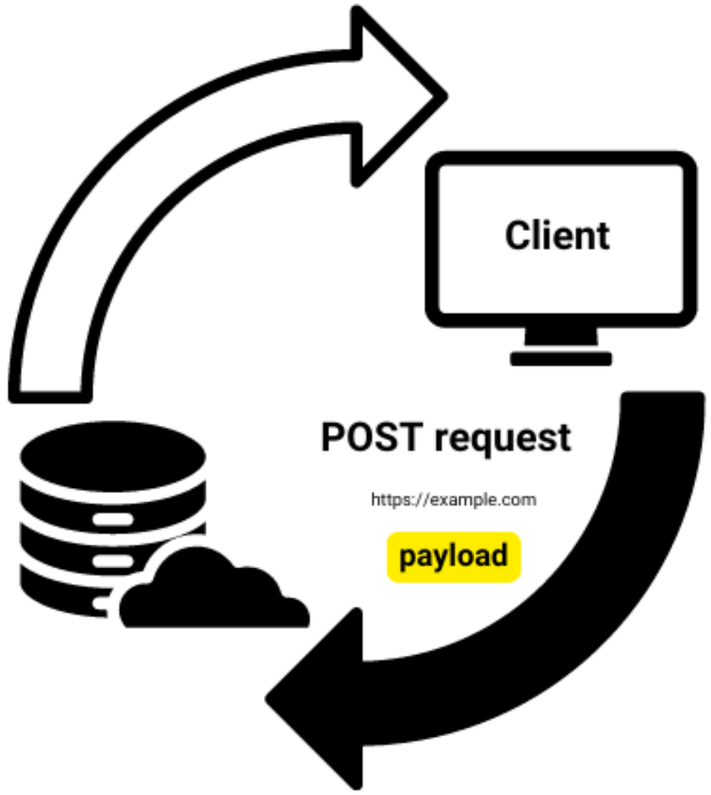
```python
from fastapi import FastAPI

app = FastAPI()

@app.get("/item/{item_id}")
async def read_item(item_id: int):
    return {"item_id": item_id}
```

- `@app.get` decorator defines endpoint.
- `{item_id}` is a path parameter.
- Type hint (`int`) for auto validation.

POST requests explained

- Used to send data to server
- Data in request body (usually JSON)
- Can change server state

```
POST https://example.com
```



Implementing POST with JSON data

```
from fastapi import FastAPI
from pydantic import BaseModel

app = FastAPI()
db = {}
class Item(BaseModel):
    name: str
    price: float
@app.post("/items", status_code=201)
def create_item(item: Item):
      db[item.name] = item.model_dump()
    return {"message":
            f"Created {item.name}"}
```

- Pydantic model defines data structure
- `@app.post` for POST endpoint
- Automatic JSON parsing and validation

HTTP status codes

- 200 OK: Default for success
- 404 Not Found: Resource not found
- 201 Success: Object created

Raising HTTP exceptions

```python
from fastapi import FastAPI, HTTPException
app = FastAPI()

@app.get("/item/{item_id}")
async def read_item(item_id: int):
    if item_id == 42:
        raise HTTPException(status_code=404, detail="Item not found")
    return {"item_id": item_id}
@app.post("/items")
async def create_item(item: Item):
    # Simulating item creation
    return {"message": f"Created {item.name}"}, 201
```

Let's practice!

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FastAPI prediction with a pre-trained model

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Setting up the environment

Required libraries:

- `FastAPI` : framework for building APIs with Python
- `uvicorn` : fast ASGI server that runs Python web apps
- `joblib` : for loading the model

```
from fastapi import FastAPI
import uvicorn
import joblib
# Create the FastAPI app instance
app = FastAPI()
```

Loading the pre-trained penguin classifier

- Trained on the Palmer Penguins dataset
- Predicts penguin species based on 4 features: culmen length, culmen depth, flipper length, and body mass
- Output: Adelie, Chinstrap, or Gentoo

```
import joblib

# Load the pre-trained model
model = joblib.load('penguin_classifier.pkl')
# Check data type of model to verify model loading
print(type(model))
```

```
<class 'sklearn.pipeline.Pipeline'>
```

[1] https://huggingface.co/SIH/penguin-classifier-sklearn

Uvicorn

- ASGI (Asynchronous Server Gateway Interface) server
- Built by and for Python

```
uvicorn main:app \
        --host 0.0.0.0 \
        --port 8080
```

```
import uvicorn
uvicorn.run(app,
            host="0.0.0.0",
            port=8080)
```

Creating the prediction endpoint

```
# FastAPI prediction endpoint
@app.post("/predict")
def predict(culmen_length_mm, culmen_depth_mm,
            flipper_length_mm, body_mass_g):

    features = [[culmen_length_mm, culmen_depth_mm,
                 flipper_length_mm, body_mass_g]]

    prediction = model.predict(features)[0]
    return {"predicted_species": prediction}
```

Running the application

```
if __name__ == "__main__":
    uvicorn.run(
      app,
      host="0.0.0.0",
      port=8080)
```

Save all the code in a python file - `your_api_script.py`

```
$ python3 your_api_script.py
```

```
INFO:     Started server process [276]
INFO:     Waiting for application startup.
INFO:     Application startup complete.
INFO:     Uvicorn running on http://0.0.0.0:8080 (Press CTRL+C to quit)
```

Testing the API

```
curl \
  -X POST "http://localhost:8080/predict" \
  -H "Content-Type: application/json" \
  -d '{"culmen_length_mm": 39.1,
       "culmen_depth_mm": 18.7,
       "flipper_length_mm": 181,
       "body_mass_g": 3750}'
```

```
{
    "prediction": "Adelie",
    "confidence": 0.87
}
```

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Request and response models

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Request and response structures in APIs

Request structure

- Data sent by the client to the API
- Typically includes:
  - HTTP method (GET, POST, etc.)
  - Headers
  - Query parameters
  - Request body

```
http://localhost:8000/users/?
email=john.doe@example.com
```

- `:8000` : The port number. FastAPI typically uses 8000 by default.
- `/users/` : The path to the specific endpoint we're accessing.
- `?` : Indicates the start of the query parameters.
- `email=john.doe@example.com`: The query parameter. In this case, we're passing an email address to the endpoint.

Response structure

- Data sent back by the API to the client
  - JSON response payload with user information
- Typically includes:
  - Status code (200 OK, 404 Not Found, etc.)
  - Headers
  - Response body (data requested or operation result)

```
HTTP/1.1 200 OK
date: Fri, 18 Oct 2024 12:34:56 GMT
server: uvicorn
content-length: 76
content-type: application/json

{
  "username": "johndoe",
  "email": "john.doe@example.com",
  "age": 30
}
```

Pydantic model

- Creation of `User`
- Use of Pydantic

```
from pydantic import BaseModel
```

```
class User(BaseModel):
    username: str
    email: str
    age: int
```

- Inherits from BaseModel
- Defines attributes with type annotations
- Automatic validation based on types

Validation error

```
from pydantic import ValidationError
try:
    invalid_user = User(username="john_doe", email="john.doe@example.com",
                        age="thirty")
    print("Invalid User:", invalid_user)
except ValidationError as e:
    print("Validation Error:", e)
```

```
Validation Error: 1 validation error for User age
Input should be a valid integer, unable to parse string as an integer
[type=int_parsing, input_value='thirty', input_type=str]
```

Using Pydantic models in FastAPI

```python
from fastapi import FastAPI
from pydantic import BaseModel
app = FastAPI()

class User(BaseModel):
    username: str
    email: str
    age: int

@app.post("/users", response_model=User)
async def create_user(user: User):
    return user
```

- Model used as `response_model`
- Model used as parameter type hint
- Automatic request validation
- De/serialization of request/response
- Generate API docs

Request and response formats

```
curl -X 'POST' \
  'http://localhost:8000/users/' \
  -H 'accept: application/json' \
  -H 'Content-Type: application/json' \
  -d '{
  "username": "john_doe",
  "email": "john.doe@example.com",
  "age": 30
  }'
```

```
{
  "username": "john_doe",
  "email": "john.doe@example.com",
  "age": 30
}
```

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