Final project

Rust 101

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Requirements

- detect and highlight faces on image
- detect faces and return bounding boxes in JSON
- distort image
- invert colors
- trim black edges
- rotate by specified degrees
- crop image by specified box
- camera functionality 👺

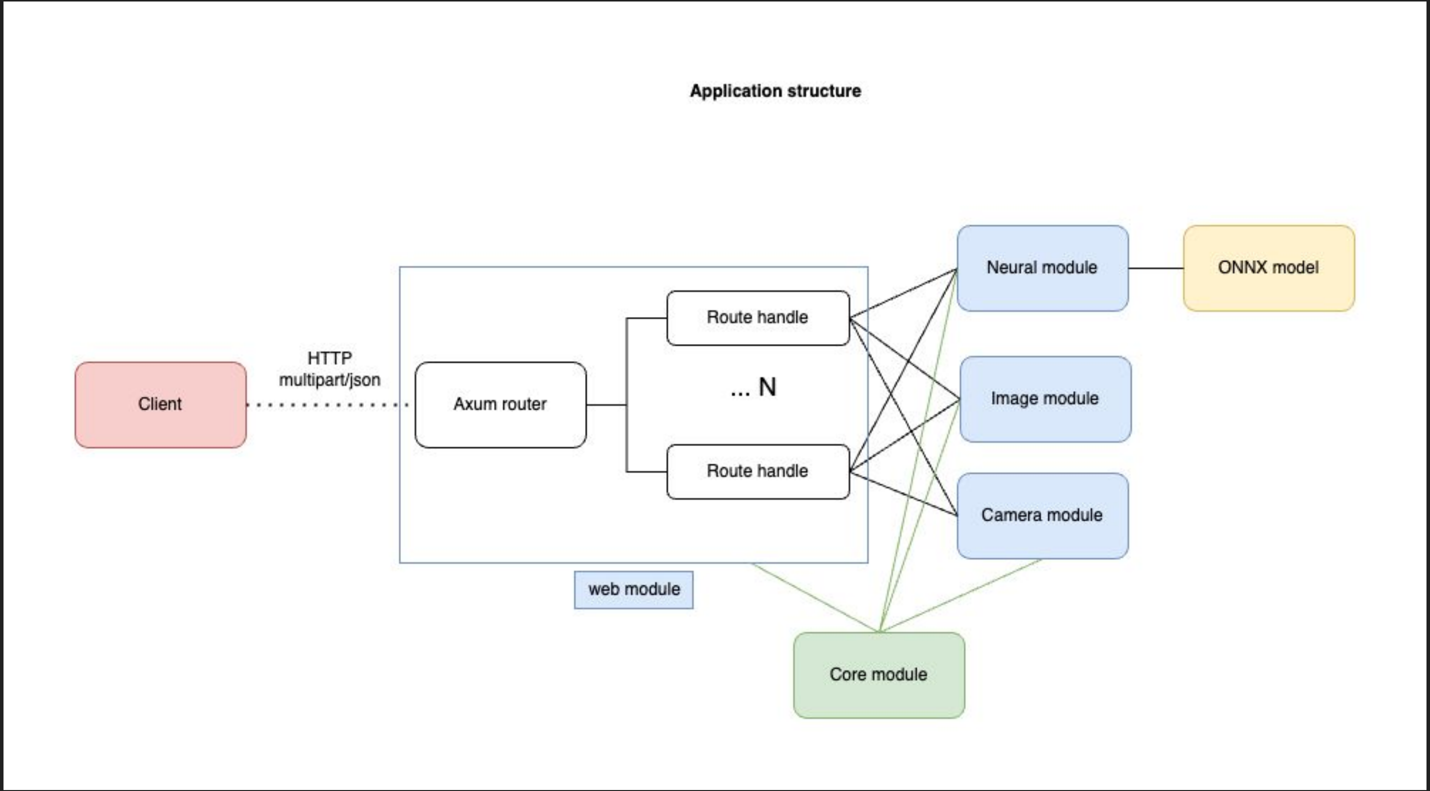
Non-functional requirements for the API

- fast processing, real-time results
- multiple requests simultaneously
- api should be intuitive
- proper error handling
- proper HTTP status handling

Introduction

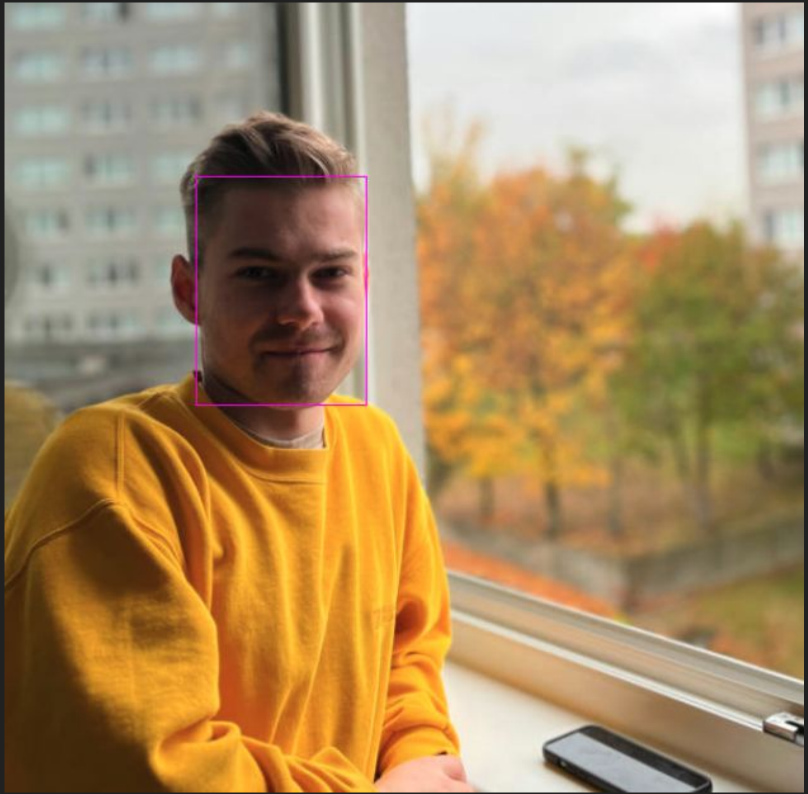
- image manipulation service
- multiple endpoints with image and query inputs and image/JSON response
- face recognition functionality

Design

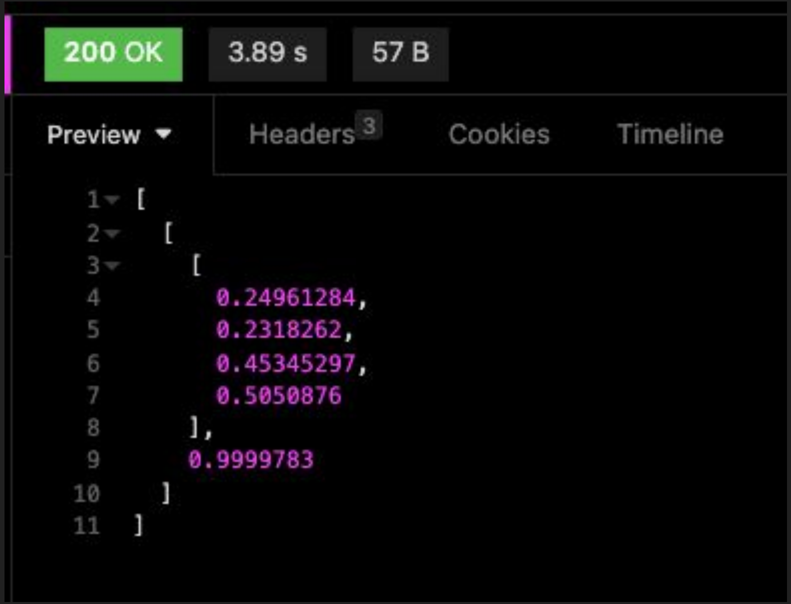

Application structure
Client
HTTP
multipart/json
Axum router
Route handle
... N
Route handle
web module
Neural module
ONNX model
Image module
Camera module
Core module

Design choices and libraries

- modules: camera, core, images, neural, web
- neural inference - ONNX using tract-onnx, UltraFace model
- backend framework - Axum
- image manipulation - using RgbImage buffer - distort, invert, trim, rotate, crop
- async runtime - Tokio - initialization and axum
- camera - Nokhwa library
- full libraries list: anyhow, axum, tokio, image, imageproc, ndarray, nokhwa, rand, reqwest, serde, smallvec, tract-onnx

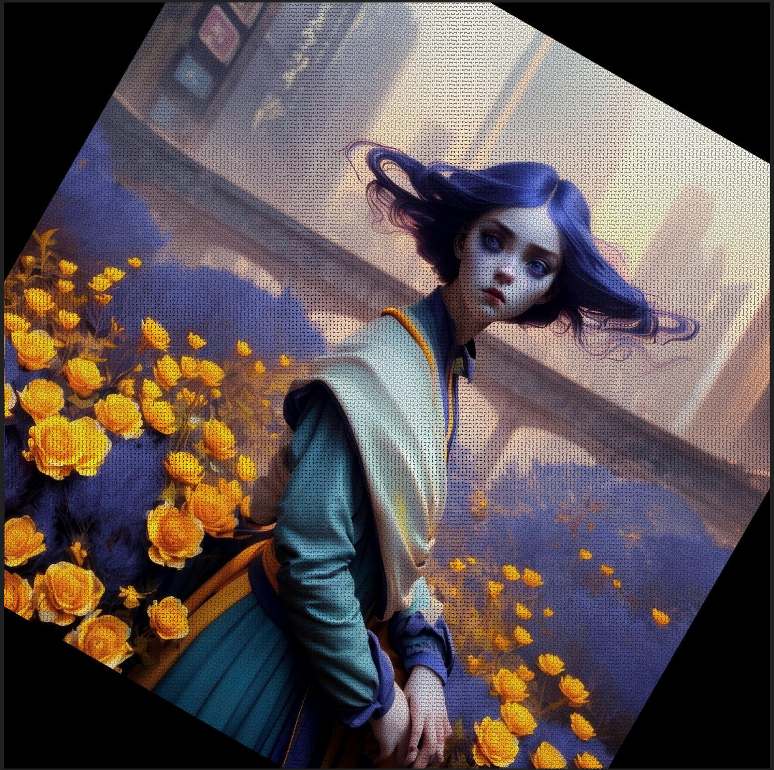


/detect

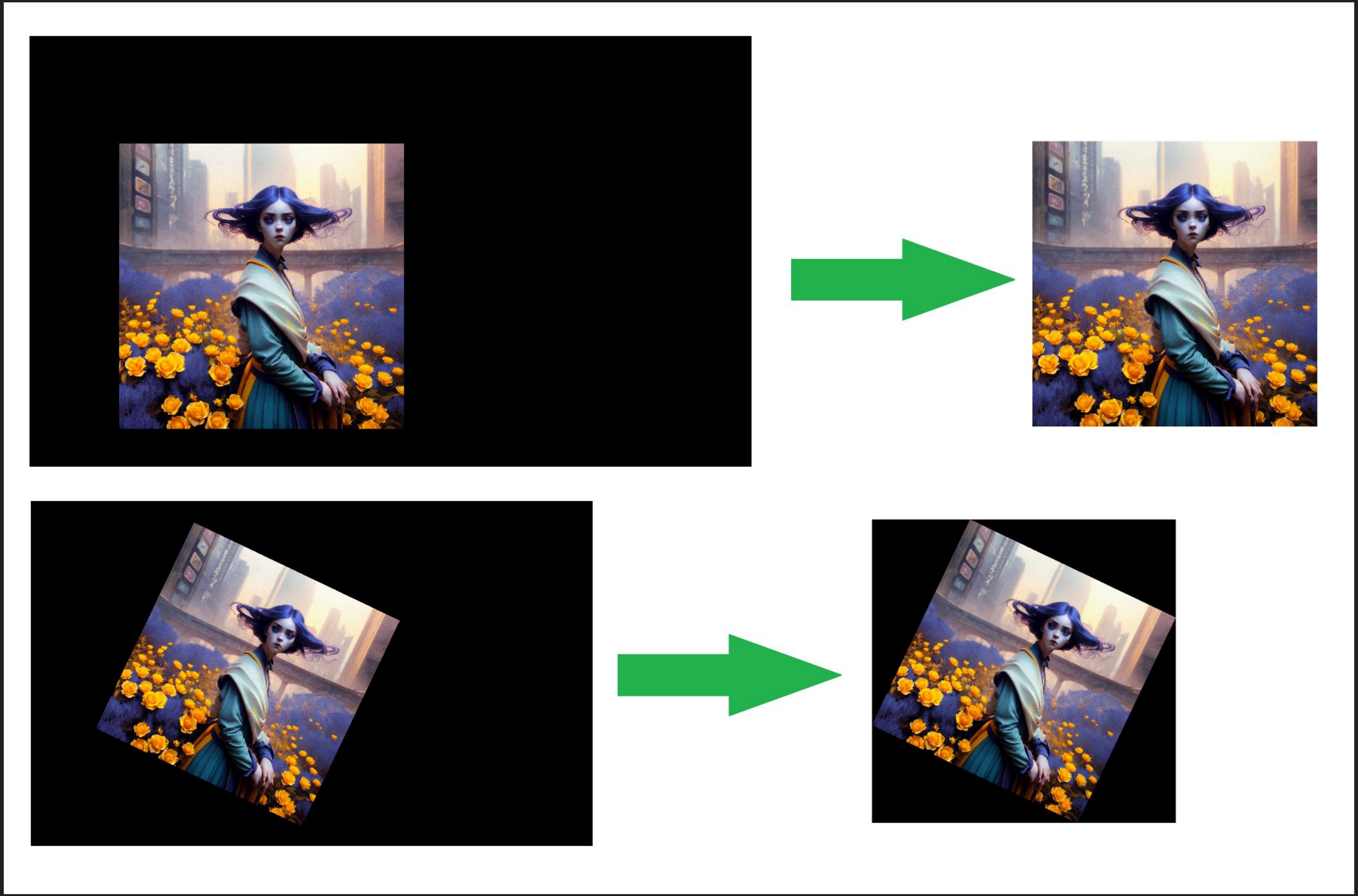


```
[
  [
    [
      0.24961284,
      0.2318262,
      0.45345297,
      0.5050876
    ],
    0.9999783
  ]
]
```

/detect-bbox

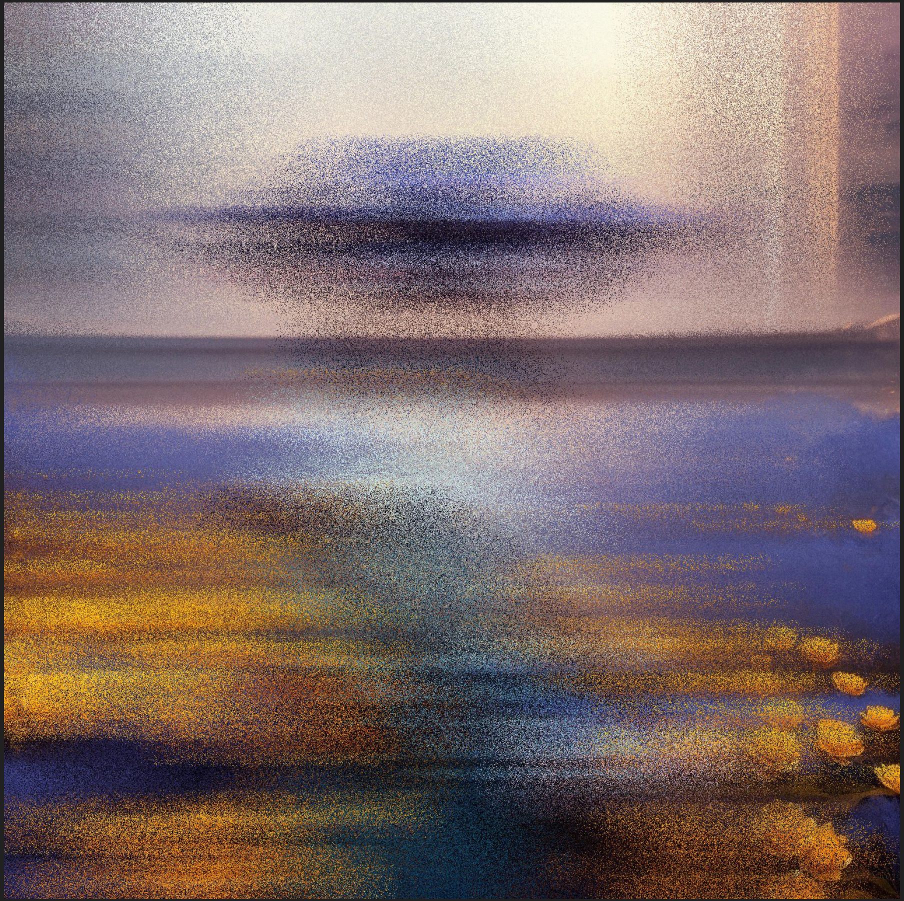

/rotate/30

/crop



/trim

/invert


/distort

Evaluation and conclusion

- fulfilled most requirements - interesting image manipulation functionality
- room for improvement (camera, multithreading, errors)
- Image manipulation functionalities
- AI model using ONNX - fully working face recognition inference, performance difficulties
- Camera functionality - explored libraries, M1 AVFoundation problem, untested
- Concurrency - Tokio, callback to async with MPSC
- Axum - served functionality as a web service using, experience