DS5619 Machine Learning System Operations

Assignment 3

1. Identify and fix all the errors in the JSON data from a student management system

Done ⇓

JSON without errors:

```
{
    "students": [
        {
            "id": 101,
            "name": "Sarah Johnson",
            "courses": [
                "CS101",
                "MATH200",
                "ENG150"
            ],
            "gpa": 3.85,
            "active": true,
            "graduation_date": null
        },
        {
            "id": 102,
            "name": "Alex Chen",
            "courses": [
                "CS101",
                "CS102",
                "STAT101"
            ],
            "gpa": 3.92,
            "active": true,
            "advisor": null,
            "notes": "Excellent student with strong analytical skills"
        },
        {
            "id": "103",
            "name": "Maria Rodriguez",
            "courses": [],
            "gpa": 3.67,
            "active": false,
            "special_programs": [
                "honors",
                "research"
            ],
        }
    ],
    "last_updated": "2024-09-15T10:30:00Z",
```

```
    "total_students": 3
}
```

2. Your web application currently uses this TOML configuration file.

```toml
[server]
host = "0.0.0.0"
port = 8080
debug = false
max_connections = 1000

[database]
url = "postgresql://localhost:5432/myapp"
pool_size = 20
timeout = 30

[logging]
level = "info"
file = "/var/log/myapp.log"
max_size = "100MB"
rotate = true

[[feature_flags]]
name = "new_ui"
enabled = true
rollout_percentage = 25

[[feature_flags]]
name = "analytics"
enabled = false
rollout_percentage = 0

[cache]
redis_url = "redis://localhost:6379/0"
ttl = 3600
```

Analyze the configuration and answer the following questions:

a. How many feature flags are currently defined, and which ones are active?

There are 2. One named "new_ui" is enabled

b. What happens when the log file reaches 100MB?

The "rotate = true" setting indicates log rotation is enabled.

When the log file exceeds 100MB, it will be rotated — typically, this means:

The current log file is archived (e.g., renamed with a timestamp or version).

A new, empty log file is created to continue logging.

Old logs may be deleted or compressed depending on the logging framework used.

c. If you wanted to make the server accessible only from localhost, what should you change?

Change host = "0.0.0.0" to host = "127.0.0.1"

d. Calculate the total number of seconds that cached items will remain valid.

`ttl` (Time to Live) for `[cache]` is set to 3600. So 3600 seconds.

e. Explain the difference between the `[feature_flags]` and `[[feature_flags]]` syntax.

- `[feature_flags]` defines a **table**, used for a single instance.
- `[[feature_flags]]` defines an **array of tables**, used to specify multiple items with the same structure.

3. Design a ML pipeline using JSON and TOML with the following features:

- a. Implement the model inference using Pytorch using pre-trained Resnet 34,50,101,152 layers. - 5 Marks
- b. Specify the data source and model architecture using JSON - 3 marks
- c. Define the model parameters such as learning rate, etc for each architecture using TOML - 3 Marks
- d. Integrate the subquestion (b) and (c) leading to a pipeline - 3 Marks
- e. Perform hyperparameter tuning (Grid search using JSON) by using learning rates = [0.1, 0.01, 0.01], optimizers = [adam, sgd] and momentum = [0.5, 0.9] - 3 Marks

All code is available in [ml_pipline] folder