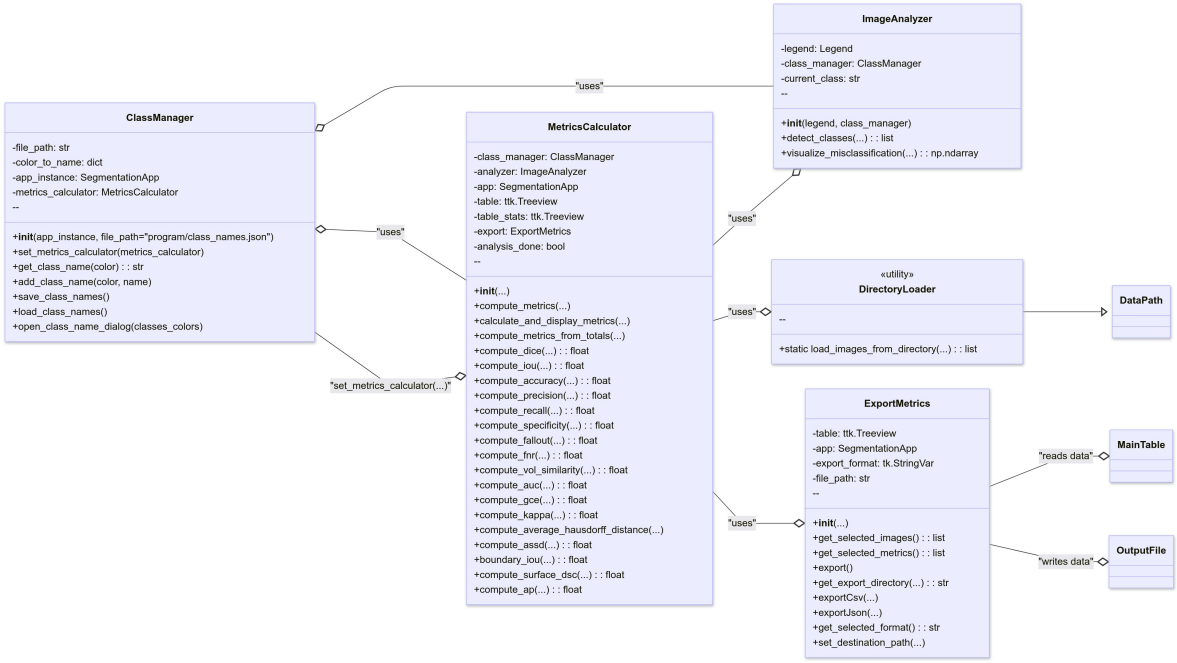
Analysis-of-the-Results-of-Image-Data-Segmentation-Methods

Specification of the requirements

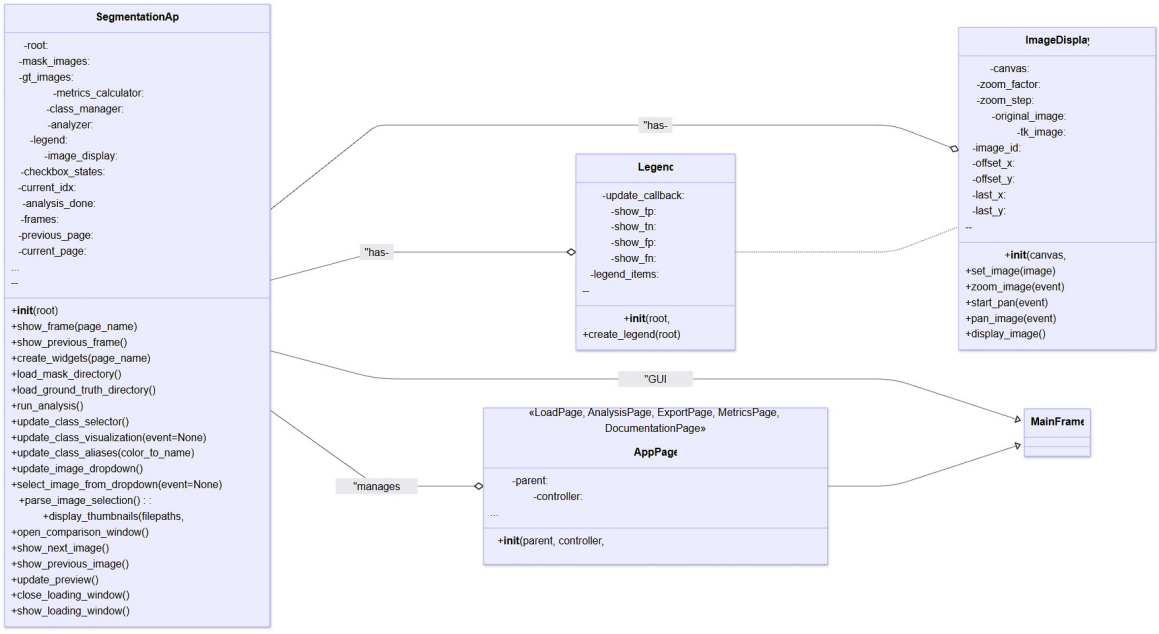
Thesis goal: Develop Python application that can analyze results of image segmentation using selected metrics. Application allows visualization, comparison and export of these metrics.
Target audience: students, researchers, developers working with image segmentation models
Requirements:

- Input: two folders with images (ground truth and prediction)
- Functionalities: calculation of metrics, visualization of classification (TP, FP, TN, FN), comparison of the results, export into CSV/JSON
- Other: simple GUI, scalability, expandability
  Solution proposal: Architecture: Application is split into modules:
- Data loading (DirectoryLoader)
- Class management (ClassManager)

- Metric calculation (MetricsCalculator)
- Visualization and export (ImageAnalyzer, ExportMetrics) UML diagrams: Function diagram – classes and their relations



User diagram – UI components and their logic



GUI design:

- Navigation panel (LOAD -> ANALYSIS -> METRICS -> EXPORT)
- Sections: Loading, Analysis, Metrics, Export

Realization and implementation

Used technologies:

- Python 3.12
- OpenCV, NumPy, SciPy, Tkinter

- Git, GitHub, Figma, TkForge Implementation:
- Calculation of metrics: functions compute_<metric_name>()
- GUI: navigation panel, interactive controls (dropdowns, checkboxes ...)
- Export: preview and format selection (CSV/JSON)

Testing and verification of the results

Data for testing:

- Simple synthetic segmentation dataset (ChatGPT) Comparison with reference values:
- Verification of metric values with existing libraries like sklearn and medpy
- Table of compared values: majority of metrics are equivalent, some variation explained in thesis Limits:
- Synthetic data results don't have to apply in all real-world scenarios
- Some metrics don't have publicly accessible implementation

Installation, usage and maintenance

Installation:

- Install supported version of Python, currently 3.12 (https://www.python.org/downloads/)
- Run `git clone https://github.com/tazman02/Analysis-of-the-Results-of-Image-Data-Segmentation-Methods` to fetch the latest version of the project
- Optional: set up virtual enviroment, recommended (tutorial: https://docs.python.org/3/library/venv.html)
- Install libraries from requirements.txt (Run: `pip install -r requirements.txt`)
- Run the main Python file from the project directory (Run: `python segmentation_app.py`) Usage:
- Load ground truth and prediction datasets (WARNING: Path cannot contain any diacritics, may cause error)
- Optional: Set class aliases for clarity in metrics
- Run the analysis module to compute evaluation results
- View results via the UI or console output
- Export computed metrics to desired format (e.g., CSV, JSON) Maintenance:
- Pull the latest version from GitHub (Run: `git pull origin main` or your current working branch)

- To add new metrics: Implement a new function in the metrics module, Update the UI to include the new metric, Submit a pull request with detailed repository comments and documentation of the changes

Structure of repository

segmentation_app.py - main Python file, launch to start the application
testy.ipynb - some of the metrics used in compariston and testing
out.json - demo of json output
ico.png = icon used by application
class_names.json - configuration file with saved class aliases, erase whole file or specific records to delete alias
lib - folder, includes all other classes that are part of the funcionality of the application
img - folder for images, contains testing and demo data
gui - folder, contains all classes that represent gui