Clinical Patient Health Monitoring & Time-Series Analysis Dashboard

A Unified Python Framework for Medical Data Visualization and Image Analytics

Malik Muhammad Ishaq

University of Paris-Est Créteil (UPEC)
Master Program

January 26, 2026

Presentation Outline

Clinical Motivation

Problem:

- Patient vital data and medical images are handled separately.
- Doctors use multiple tools at the same time.
- This increases workload and decision time.

Solution:

- One unified dashboard for monitoring and analysis.
- Clear visualization of trends and risks.

Project Objectives

- Build a modular clinical dashboard using Python.
- Monitor patient vital signs using time-series data.
- Apply basic medical image processing techniques.
- Automatically classify patient risk levels.
- Store and manage data using MySQL.

System Architecture

- **Frontend:** Tkinter-based dashboard with tabs.
- **Processing:** Pandas and NumPy.
- **Visualization:** Matplotlib.
- **Database:** MySQL.
- **Image Processing:** scikit-image.

System Refinement & Professor Feedback

Professor's Critique & Improvements:

- **Simplified UI:** Reduced complexity of the dashboard for better usability.
- **Data Loading:** Switched from CSV-only to MySQL Data Management for scalability.
- **Stabilization:** Fixed bugs in the Image Processing module to ensure proper rendering.

Result:

- A cleaner, more professional interface with a robust database backend.

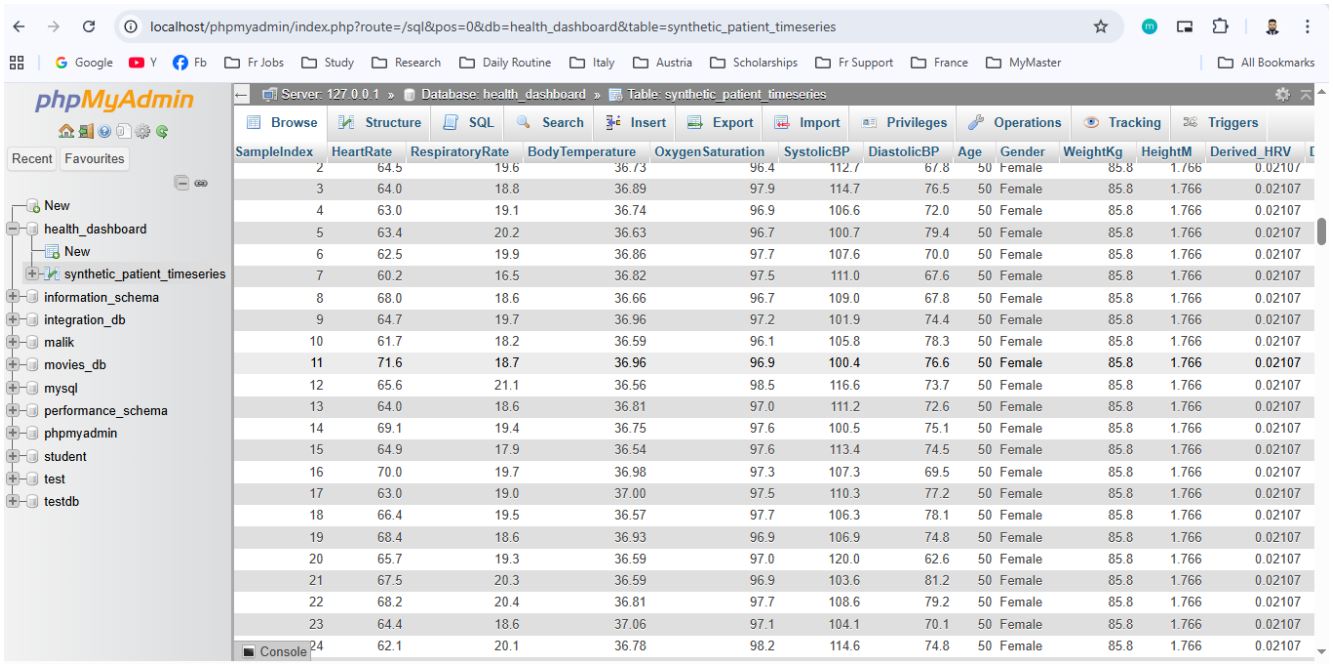
Dashboard: Data Management

Purpose:

- Manage patient records and vital-sign data.
- Ensure clean and valid data for analysis.

Main Functions:

- Load data from CSV files or database.
- Handle missing and incorrect values.
- Refresh and validate database tables.



SampleIndex	HeartRate	RespiratoryRate	BodyTemperature	OxygenSaturation	SystolicBP	DiastolicBP	Age	Gender	WeightKg	HeightM	Derived_HRV
2	64.5	19.6	36.73	96.4	112.7	67.8	50	Female	85.8	1.766	0.02107
3	64.0	18.8	36.89	97.9	114.7	76.5	50	Female	85.8	1.766	0.02107
4	63.0	19.1	36.74	96.9	106.6	72.0	50	Female	85.8	1.766	0.02107
5	63.4	20.2	36.63	96.7	100.7	79.4	50	Female	85.8	1.766	0.02107
6	62.5	19.9	36.86	97.7	107.6	70.0	50	Female	85.8	1.766	0.02107
7	60.2	16.5	36.82	97.5	111.0	67.6	50	Female	85.8	1.766	0.02107
8	68.0	18.6	36.66	96.7	109.0	67.8	50	Female	85.8	1.766	0.02107
9	64.7	19.7	36.96	97.2	101.9	74.4	50	Female	85.8	1.766	0.02107
10	61.7	18.2	36.59	96.1	105.8	78.3	50	Female	85.8	1.766	0.02107
11	71.6	18.7	36.96	96.9	100.4	76.6	50	Female	85.8	1.766	0.02107
12	65.6	21.1	36.56	98.5	116.6	73.7	50	Female	85.8	1.766	0.02107
13	64.0	18.6	36.81	97.0	111.2	72.6	50	Female	85.8	1.766	0.02107
14	69.1	19.4	36.75	97.6	100.5	75.1	50	Female	85.8	1.766	0.02107
15	64.9	17.9	36.54	97.6	113.4	74.5	50	Female	85.8	1.766	0.02107
16	70.0	19.7	36.98	97.3	107.3	69.5	50	Female	85.8	1.766	0.02107
17	63.0	19.0	37.00	97.5	110.3	77.2	50	Female	85.8	1.766	0.02107
18	66.4	19.5	36.57	97.7	106.3	78.1	50	Female	85.8	1.766	0.02107
19	68.4	18.6	36.93	96.9	106.9	74.8	50	Female	85.8	1.766	0.02107
20	65.7	19.3	36.59	97.0	120.0	62.6	50	Female	85.8	1.766	0.02107
21	67.5	20.3	36.59	96.9	103.6	81.2	50	Female	85.8	1.766	0.02107
22	68.2	20.4	36.81	97.7	108.6	79.2	50	Female	85.8	1.766	0.02107
23	64.4	18.6	37.06	97.1	104.1	70.1	50	Female	85.8	1.766	0.02107
24	62.1	20.1	36.78	98.2	114.6	74.8	50	Female	85.8	1.766	0.02107

Figure: Data Management Module

Dashboard: Patient Trends

Purpose:

- Monitor individual patient health over time.

Features:

- Patient ID and vital-sign selection.
- Time-series plots with zoom control.

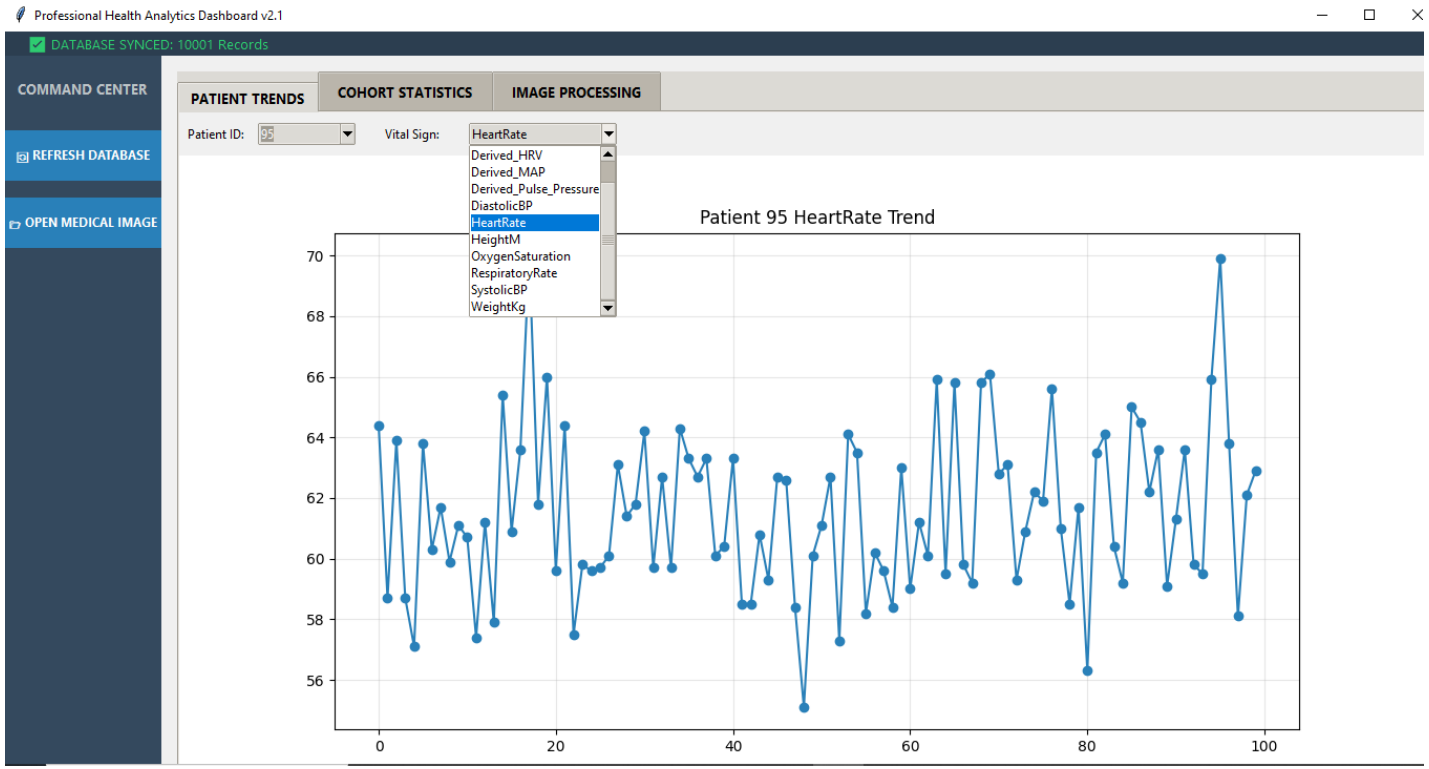


Figure: Patient Trends Dashboard

Dashboard: Statistics Visualization

Purpose:

- Analyze health data of all patients together.

Analysis Tools:

- Charts
- BMI Histograms
- MAP Histograms
- Risk-based scatter plots

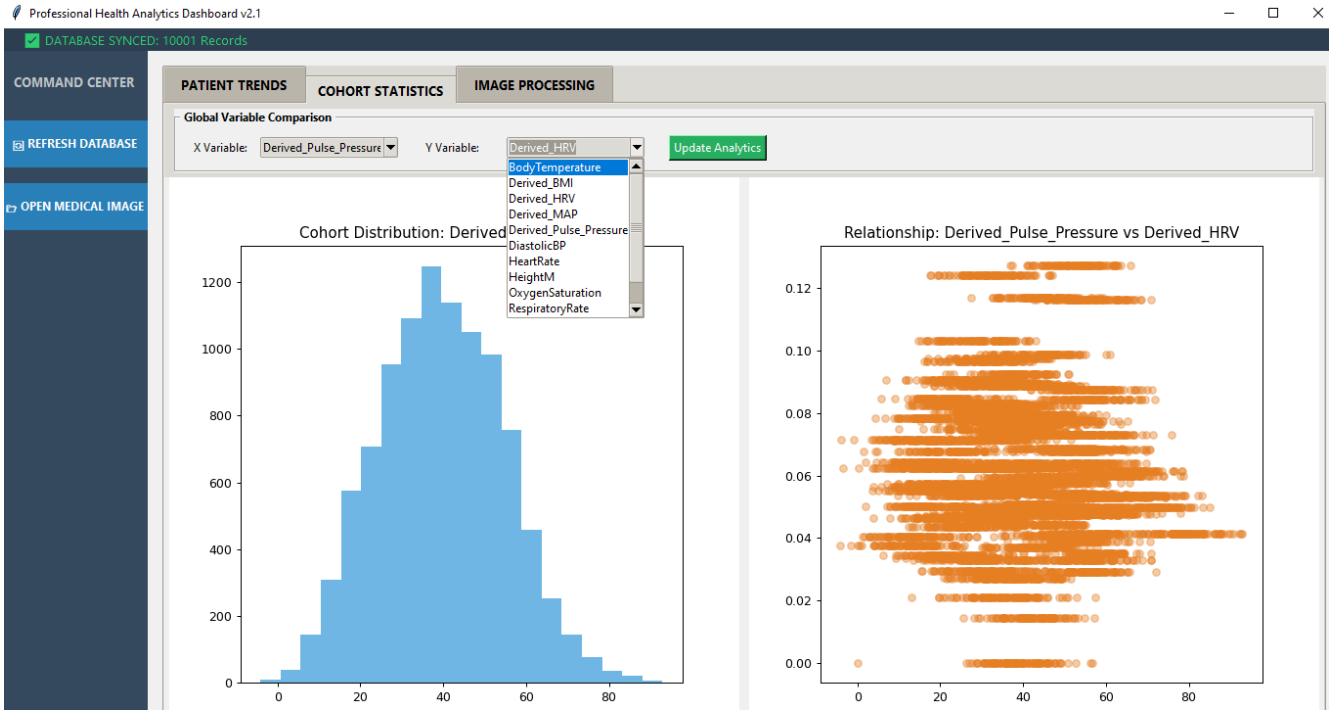


Figure: Cohort Statistics Dashboard

Dashboard: Image Processing

Purpose:

- Assist basic medical image analysis.

Available Options:

- Convert image to Grayscale.
- Apply Gaussian Blur for noise reduction.
- Detect edges using Canny algorithm.

Figure: Image Processing Dashboard

Image Processing Techniques

Grayscale Conversion:

- Converts image to intensity values.
- Simplifies medical image analysis.

Gaussian Blur:

- Removes noise and smooths the image.
- Helps improve edge detection.

Canny Edge Detection:

- Detects boundaries and structures.
- Useful for lesion and organ detection.

Implementation Challenges

Challenges:

- MySQL connector installation issues.
- GUI freezing during heavy processing.
- Embedding plots in Tkinter.

Solutions:

- Correct library usage.
- Background processing.
- Embedded Matplotlib canvas.

Results & Performance

- Easy-to-use and responsive dashboard.
- Correct identification of at-risk patients.
- Supports PNG, JPG, and DICOM images.
- Suitable for education and research.

Limitations & Conclusion

Limitations:

- Uses synthetic data only.
- Image processing limited to 2D.

Future Work:

- AI-based risk prediction.
- Cloud-based deployment.
- In Image processing Part, Can add more filters.

Thank you! Any questions?