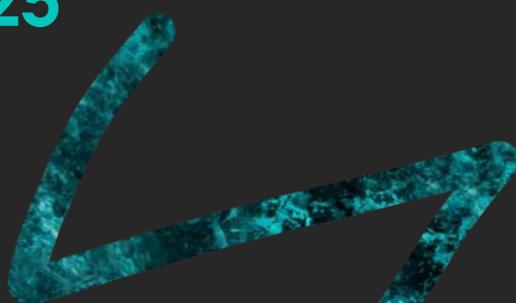


22/02/2025

Profiles assignment - GITHUB project - By Abdel YEZZA (Ph. D) – 2025



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MCAP - Profile-Activity Matching System

License MIT python 3.8+

Core Dependencies

Python 3.8+ NumPy 1.26.4+ Pandas 2.2.1+ Scikit-learn 1.3.2+ FastAPI 0.115.8+ Matplotlib 3.8.2+
React 18.0+ Node.js 18.0+ NPM 9.0+

A Python package designed for optimal profile-to-activity assignment based on skills matching, developed by Abdel YEZZA (Ph.D). This solution employs advanced algorithms to maximize the correspondence between required activity competencies and available profile skills.

It is designed to provide a comprehensive solution for profile-activity matching, offering multiple models, flexible scaling options, complete web application, streamlit web interface, a robust logging system, a detailed validation of input data, and customizable processing of MCAP functions (sum, mean, Euclidean and any custom function).

This project is built on the two following articles presenting all the concepts and basic elements:

1. [UN NOUVEAU MODELE POUR AFFECTER LES PROFILS ADEQUATS](#) - by Abdel YEZZA (Ph.D) - 2024
2. [UNE NOUVELLE FAÇON D'AFFECTATION DES PROFILS AUX ACTIVITES](#) - by Abdel YEZZA (Ph.D) - 2022

Key Features

- **Skills Matrix Analysis:** Process and analyze competency-activity (MCA) and competency-profile (MCP) matrices
- **Multiple Model Support:** Five different matching models available (model1 through model5 or any custom function)
- **Flexible Scaling:** Support for different scale types (0-1, free)
- **Web Interface:** Built-in web application using FastAPI and Streamlit
- **Detailed Logging:** Comprehensive logging system for tracking operations
- **Data Validation:** Robust input validation and error handling
- **Customizable Processing:** Support for different MCAP functions (sum, mean, euclidean and any custom function)

🔧 Installation

1. Clone the repository:

```
git clone [repository-url]  
cd profiles_assignment
```

2. Create and activate a virtual environment (recommended):

```
# install venv on Linux/MacOS:  
python -m venv venv  
source venv/bin/activate  
# to activate on Windows:  
venv\Scripts\activate  
Install dependencies:  
pip install -r requirements.txt
```

📦 Dependencies

- streamlit >= 1.24.0
- pandas >= 1.5.0
- scikit-learn
- matplotlib
- fastapi >= 0.104.0
- uvicorn >= 0.24.0
- python-dotenv >= 1.0.0
- python-multipart >= 0.0.6
- sqlalchemy >= 2.0.23

🚀 Usage

Command-Line Interface

Basic usage:

```
python main.py
```

Advanced usage with custom parameters:

```
python main.py --mca path/to/mca.csv --mcp path/to/mcp.csv --model model_name --scale  
scale_type --mcap mcap_function
```

Example:

```
python main.py --mca .\data\input\mca.csv --mcp .\data\input\mcp.csv --model model5 --  
scale 0-1 --mcap sqrt
```

📋 Command Line Arguments (Console case)

- --mca: Path to the MCA (Matrix Competency-Activity) file
- --mcp: Path to the MCP (Matrix Competency-Profile) file
- --model: Model selection (model1, model2, model3, model4, model5 or your own model function)
- --scale: Scale type (0-1 or free)
- --mcap: MCAP function type (sum, mean, sqrt or a custom MCAP function)

📋 Input File Formats

MCA (Competency-Activity Matrix)

```
Activity,Comp1,Comp2,Comp3
Activity1,0.8,0.6,0.7
Activity2,0.5,0.9,0.4
```

MCP (Competency-Profile Matrix)

```
Profile,Comp1,Comp2,Comp3
Profile1,0.7,0.8,0.6
Profile2,0.9,0.5,0.8
```

Running the previous example

```
python main.py --mca .\data\input\mca.csv --mcp .\data\input\mcp.csv --model model5 --
scale 0-1 --mcap sqrt
```

should have an **output** log like the following:

```
2025-02-22 11:51:32 - myLogger - INFO - Starting command-line processing
2025-02-22 11:51:32 - myLogger - INFO - Processing with parameters:
2025-02-22 11:51:32 - myLogger - INFO - - Model: model5
2025-02-22 11:51:32 - myLogger - INFO - - Scale: 0-1
2025-02-22 11:51:32 - myLogger - INFO - - MCAP: sqrt

...
2025-02-22 11:51:32 - myLogger - INFO - Initialized processor with parameters:
2025-02-22 11:51:32 - myLogger - INFO - - mca_matrix shape: (10, 10)
2025-02-22 11:51:32 - myLogger - INFO - - mcp_matrix:          Comp1  Comp2  Comp3  Comp4  Comp5
Comp6  Comp7  Comp8  Comp9  Comp10
Profile
Prof1    0.9    0.5    0.3    0.8    0.6    0.7    0.4    0.8    0.5    0.6
Prof2    0.4    0.8    0.6    0.5    0.7    0.9    0.3    0.7    0.4    0.8
Prof3    0.6    0.4    0.9    0.7    0.5    0.8    0.6    0.4    0.9    0.3
Prof4    0.8    0.7    0.4    0.9    0.3    0.6    0.8    0.5    0.7    0.4
Prof5    0.5    0.9    0.7    0.4    0.8    0.3    0.7    0.6    0.8    0.5
Prof6    0.7    0.3    0.8    0.6    0.4    0.9    0.5    0.7    0.3    0.8
Prof7    0.9    0.6    0.5    0.8    0.7    0.4    0.9    0.3    0.6    0.7
Prof8    0.3    0.8    0.7    0.5    0.9    0.6    0.4    0.8    0.5    0.9
Prof9    0.8    0.4    0.9    0.3    0.6    0.7    0.5    0.9    0.4    0.6
Prof10   0.6    0.9    0.4    0.7    0.5    0.8    0.3    0.6    0.8    0.5
2025-02-22 11:51:32 - myLogger - INFO - - mcp_matrix shape: (15, 10)
```

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```

2025-02-22 11:51:32 - myLogger - INFO - - mcp_matrix:
Comp6 Comp7 Comp8 Comp9 Comp10
Profile
Prof1    0.9    0.5    0.3    0.8    0.6    0.7    0.4    0.8    0.5    0.6
Prof2    0.4    0.8    0.6    0.5    0.7    0.9    0.3    0.7    0.4    0.8
Prof3    0.6    0.4    0.9    0.7    0.5    0.8    0.6    0.4    0.9    0.3
Prof4    0.8    0.7    0.4    0.9    0.3    0.6    0.8    0.5    0.7    0.4
Prof5    0.5    0.9    0.7    0.4    0.8    0.3    0.7    0.6    0.8    0.5
Prof6    0.7    0.3    0.8    0.6    0.4    0.9    0.5    0.7    0.3    0.8
Prof7    0.9    0.6    0.5    0.8    0.7    0.4    0.9    0.3    0.6    0.7
Prof8    0.3    0.8    0.7    0.5    0.9    0.6    0.4    0.8    0.5    0.9
Prof9    0.8    0.4    0.9    0.3    0.6    0.7    0.5    0.9    0.4    0.6
Prof10   0.6    0.9    0.4    0.7    0.5    0.8    0.3    0.6    0.8    0.5
...
2025-02-22 11:51:32 - myLogger - INFO - MCAP matrix sample:
Profile Prof1 Prof2 Prof3 Prof4 Prof5 Prof6 Prof7 Prof8 Prof9 Prof10
Profile1 Prof12 Prof13 Prof14 Prof15
Activity
Act1     1.844135 1.804701 1.851501 1.836739 1.767138 1.784657 1.865625 1.861451 1.797143 1.863017
1.871348 1.790639 1.831438 1.908897 1.850976
Act2     1.752379 1.800540 1.668249 1.757919 1.821477 1.703428 1.911079 1.934339 1.726670 1.745709
1.823077 1.809159 1.858987 1.711400 1.805393
Act3     1.688935 1.663413 1.819722 1.775372 1.822392 1.721434 1.921082 1.820256 1.780839 1.668083
1.849399 1.851501 1.750000 1.802005 1.835151
Act4     1.843005 1.838780 1.799228 1.851426 1.779123 1.815902 1.870754 1.915942 1.802467 1.852476
1.867113 1.789475 1.923538 1.842477 1.840365
Act5     1.781853 1.754360 1.875426 1.790562 1.849850 1.790019 1.965042 1.888341 1.844060 1.758787
1.922527 1.878534 1.781853 1.923033 1.911878
Act6     1.820256 1.897659 1.782476 1.777014 1.772083 1.853600 1.854649 1.984313 1.821324 1.829845
1.897659 1.772631 1.935200 1.832500 1.874463
Act7     1.698283 1.697138 1.828402 1.754597 1.843758 1.733974 1.892676 1.838478 1.837949 1.684488
1.864210 1.878755 1.735655 1.797838 1.846919
Act8     1.809926 1.893923 1.748730 1.776310 1.777951 1.814754 1.834999 1.974842 1.801311 1.822773
1.875352 1.781775 1.922455 1.776857 1.848723
Act9     1.709532 1.704976 1.810080 1.725382 1.831969 1.711237 1.902776 1.867708 1.790639 1.688935
1.830376 1.860929 1.729884 1.811690 1.815978
Act10   1.776232 1.771848 1.809850 1.861749 1.806085 1.697302 1.880972 1.854948 1.696729 1.850225
1.833333 1.764149 1.831211 1.817889 1.815749
2025-02-22 11:51:32 - myLogger - INFO - Ranking matrix generated successfully
2025-02-22 11:51:32 - myLogger - INFO - MCAP matrix shape: (10, 3)
2025-02-22 11:51:32 - myLogger - INFO - MCAP matrix sample:
Top1          Top2          Top3
Activity
Act1     Prof14 (1.909)  Prof11 (1.871)  Prof7 (1.866)
Act2     Prof8 (1.934)   Prof7 (1.911)   Prof13 (1.859)
Act3     Prof7 (1.921)   Prof12 (1.852)   Prof11 (1.849)
Act4     Prof13 (1.924)  Prof8 (1.916)   Prof7 (1.871)
Act5     Prof7 (1.965)   Prof14 (1.923)   Prof11 (1.923)
Act6     Prof8 (1.984)   Prof13 (1.935)   Prof2 (1.898)
Act7     Prof7 (1.893)   Prof12 (1.879)   Prof11 (1.864)
Act8     Prof8 (1.975)   Prof13 (1.922)   Prof2 (1.894)
Act9     Prof7 (1.903)   Prof8 (1.868)   Prof12 (1.861)
Act10   Prof7 (1.881)   Prof4 (1.862)   Prof8 (1.855)
...
2025-02-22 11:51:32 - myLogger - INFO - Ranking matrix saved to: data\output\ranking_matrix.csv
2025-02-22 11:51:32 - myLogger - INFO - Ranking matrix saved to: data\output\ranking_matrix.csv
2025-02-22 11:51:33 - myLogger - INFO - Matrice MCAP sauvegardée dans: data\output\mcap_matrix.txt
2025-02-22 11:51:33 - myLogger - INFO - Matrice MCAP sauvegardée dans: data\output\mcap_matrix.txt
2025-02-22 11:51:33 - myLogger - INFO - MCAP matrix saved to: data\output\mcap_matrix.csv
2025-02-22 11:51:41 - myLogger - INFO - Traitement terminé avec succès

```

Web application

1. Backend

```
# go to backend folder  
cd web/backend  
  
# Install dépendances if any  
pip install -r requirements.txt  
  
# Run the serveur with unicorn  
unicorn main:app --reload --log-level debug
```

2. Frontend

```
# go to frontend folder  
cd web/frontend  
  
# Install dépendances if any  
npm install  
  
# Run the dev server  
npm start
```

You should get a message like:

```
Local:          http://localhost:3001  
On Your Network: http://192.168.1.19:3001
```

You can now view mcap-frontend in the browser.

The web main interface looks like this:

The screenshot shows a web application titled "Affectation des Profils". The main page is titled "Configuration". It features two blue buttons: "MCA_01.CSV" and "MCP_01.CSV". Below these buttons are three dropdown menus:

- Modèle: "Modèle 5 (moyenne pondérée)"
- Type d'échelle: "Échelle [0,1]"
- Fonction MCAP: "Racine carrée"

At the bottom of the form is a blue button labeled "CALCULER LA MATRICE MCAP".

Fig.1. Web output_1

Depending on made options and input CSV matrices (mca and mcp), results look like this:

Classement des profils par activité			
Activity	Top 1	Top 2	Top 3
Act1	Prof3 (1.852)	Prof1 (1.844)	Prof4 (1.837)
Act2	Prof5 (1.821)	Prof2 (1.801)	Prof4 (1.758)
Act3	Prof5 (1.822)	Prof3 (1.820)	Prof4 (1.775)
Act4	Prof4 (1.851)	Prof1 (1.843)	Prof2 (1.839)
Act5	Prof3 (1.875)	Prof5 (1.850)	Prof4 (1.791)

Matrice des résultats détaillée					
Activity	Prof1	Prof2	Prof3	Prof4	Prof5
Act1	1.844	1.805	1.852	1.837	1.767
Act2	1.752	1.801	1.668	1.758	1.821
Act3	1.689	1.663	1.820	1.775	1.822
Act4	1.843	1.839	1.799	1.851	1.779
Act5	1.782	1.754	1.875	1.791	1.850

Fig.2. Web output_2

Résultats de l'analyse MCAP

Parameters Used

Model: model5
Scale Type: 0-1
MCAP Function: sqrt

Graphiques

Distribution des poids

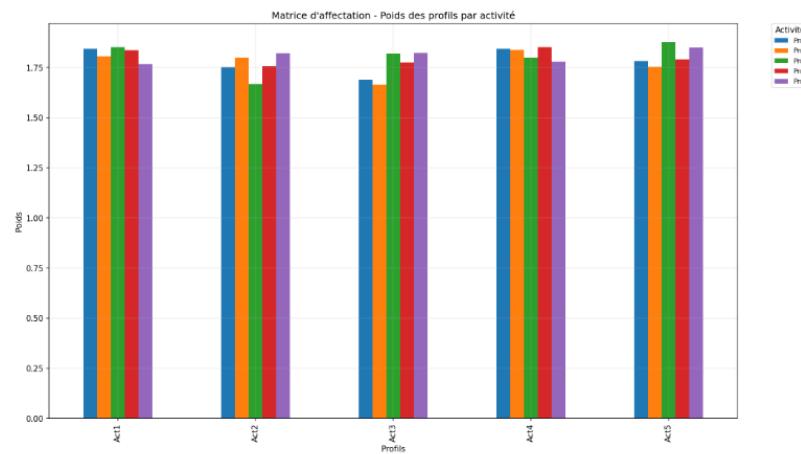


Fig.3. Web output_3

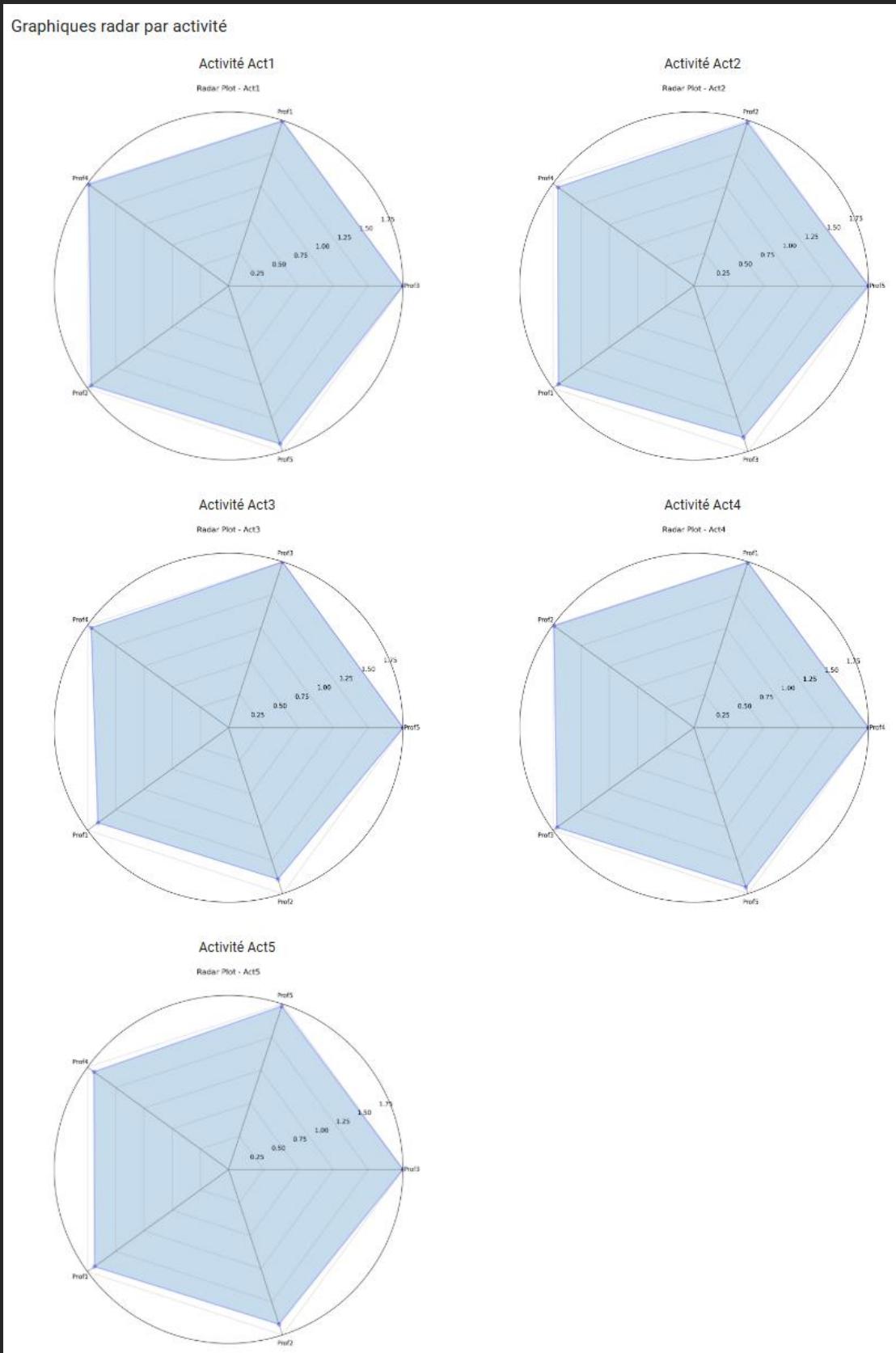


Fig.4. Web output_4

Streamlit demo application

streamlit.cmd run .\src\streamlit\app.py

You should have three menu items:

- Start page
- Test application
- Interactive application

Testing panel is equivalent to the WEB application and looks like this:

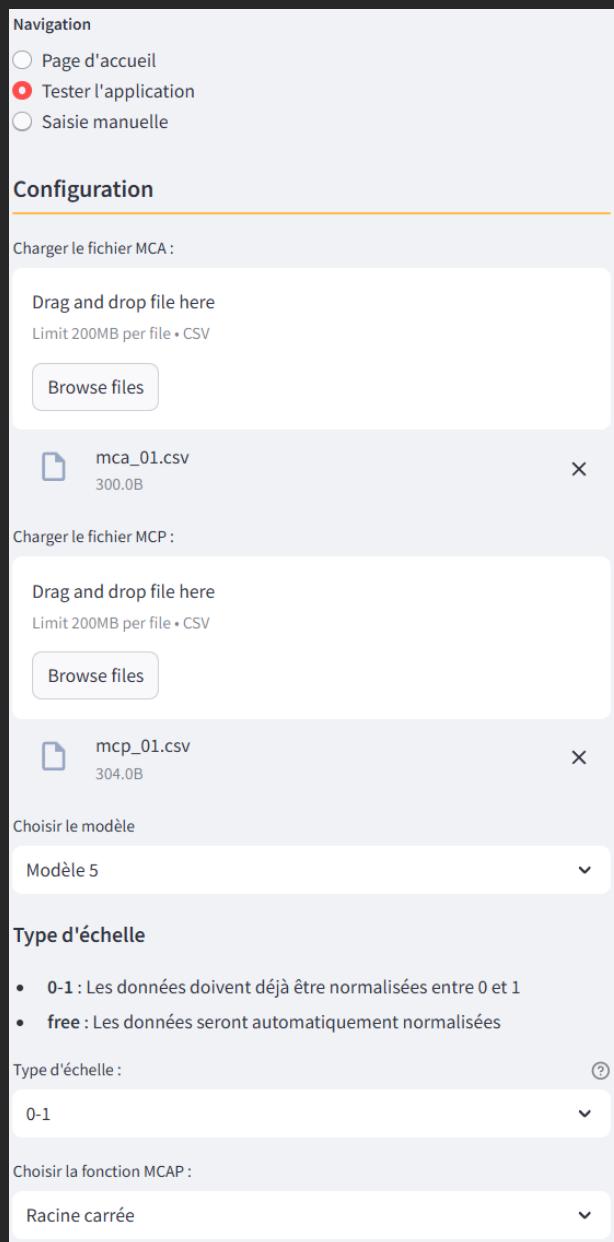


Fig.5. Streamlit output_1

Interactive application panel looks like this:

Affectation des profils aux activités

Navigation

- Page d'accueil
- Tester l'application
- Saisie manuelle

Configuration

Choisir le modèle :

Modèle 5

Type d'échelle

free

Choisir la fonction MCAP

Moyenne

Saisie manuelle des données

Nombre d'activités

4

- +
Nombre de profils

4

- +

Nombre de compétences

4

Matrice MCA (Compétences des Activités)

	Comp1	Comp2	Comp3	Comp4
Act1	2	1	2	4
Act2	5	4	4	2
Act3	2	0	1	3
Act4	4	0	4	4

Exporter MCA

Matrice MCP (Compétences des Profils)

	Comp1	Comp2	Comp3	Comp4
Prof1	5	4	3	1
Prof2	1	3	3	2
Prof3	3	2	3	3
Prof4	4	1	2	0

Dimensions de la matrice MCA : (4, 4)
Dimensions de la matrice MCP : (4, 4)

Exporter MCP
 Lancer le traitement

Traitement en cours...

Fig.6. Streamlit output_2

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Project Structure

```
profiles_assignment/
├── src/                      # Source code
│   ├── core/                  # Core processing logic
│   │   ├── __init__.py
│   │   └── mcap_processor.py
│   ├── models/                 # Model implementations
│   │   ├── __init__.py
│   │   ├── mcap_functions.py
│   │   └── model_functions.py
│   ├── utils/                  # Utility functions
│   │   ├── __init__.py
│   │   └── logger.py
│   └── streamlit/              # Streamlit app components
│       └── app.py
└── web/                       # Web application
    ├── backend/                # FastAPI backend
    │   ├── app/
    │   │   ├── routes.py
    │   │   ├── models.py
    │   │   └── database.py
    │   ├── config/
    │   └── main.py
    └── frontend/                # React frontend
        ├── public/
        └── src/
├── config/                    # Configuration files
└── mylogger.ini               # Logging configuration
├── data/                      # Data files
│   ├── input/                  # Input CSV files
│   └── output/                 # Generated outputs
│       └── figures/            # Generated plots
└── tests/                     # Test suite
└── requirements.txt           # Python dependencies
└── main.py                    # CLI entry point
└── README.md                  # Project documentation
```

License

This project is open source and available under the MIT License.

Contributing

Contributions are welcome! Please feel free to submit a Pull Request.