Lynch Lab MedPC Analyzer 🧬

Version 4.6 (Scalar-Priority Engine)

1. Overview

The **Lynch Lab MedPC Analyzer** is a custom software suite designed to automate the processing of behavioral data files (MedPC). It eliminates manual data extraction, prevents human error, and instantly generates publication-ready visualizations.

Key Capabilities

- **Hybrid Parsing Engine:** Automatically detects data whether stored as *Scalars* (single numbers like A: 15) or *Arrays* (time-series like A: 0: 10.2...), ensuring compatibility with both old and new MedPC protocols.
- **Strict Protocol Separation:** Automatically sorts data into separate Excel files based on the experiment type (e.g., "FR20" vs. "FR40").
- **Maximalist Visualization:** Generates 12 distinct chart types per experiment, including hourly "micro-analysis," daily learning trajectories, and gender-split comparisons.
- **Traceability:** Every data point is tagged with its original source filename for complete audit trails.

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2. How to Access

Option A: The Web App (Recommended)

Best for: Mac users, mobile access, and quick checks in the colony room.

- **Link:** https://lynch-lab-medpc.streamlit.app
- **No Installation:** Works instantly in Chrome, Safari, or Edge on any device (iPhone, Android, iPad, PC, Mac).

Option B: Desktop App (Windows/Mac)

Best for: High-volume processing of large datasets on lab computers.

- **Windows:** Download Lynch Lab MedPC Analyzer.exe and double-click to run.
- **Mac:** Download Lynch_Lab_Analyzer.app.
  - *Note:* On first launch, right-click the icon and select **Open** to bypass the macOS security warning.

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3. Step-by-Step Usage Guide

Step 1: Data Preparation

Before running the app, ensure your files are ready:

1. **Raw Files:** Ensure your raw MedPC files start with ! (e.g., !2025-06-20_RatData.txt).
2. **ID List:** Create a text file (ids.txt) containing the Subject IDs you want to analyze, one per line.
    - *Note:* The app handles "O" vs "0" confusion automatically (e.g., O105 matches 0105).

Step 2: Running the Analysis

1. **Launch the App** (Web or Desktop).
2. **Select Data Folder:** Choose the folder containing your raw !*.txt files.
3. **Select ID List:** Upload your ids.txt file.
4. **Click "START PROCESSING".**

Step 3: Interpreting the Output

The app creates a new Excel file for **each protocol** found (e.g., RAT_FR20_Analysis.xlsx). Inside, you will find 7 sheets:

- **01_Session_Data:** Raw summary of every session.
- **02_Hourly_Data:** Hour-by-hour breakdown of infusions and presses.
- **03_Daily_Summaries:** Total intake aggregated by date.
- **04_Subject_Averages:** Mean performance per animal across all days.
- **05_Gender_Comparison:** Statistical summary split by Male/Female.
- **06_Sessions_Per_Subject:** Count of how many sessions each animal completed.
- **07_Data_Quality_Flags:** Warnings for suspicious data (e.g., 0 infusions in a 3-hour session).

Plus a Plots/ folder containing:

- **Daily Trajectories:** To spot learning curves (upward slope) or extinction (downward slope).
- **Hourly Histograms:** To identify "front-loading" or binging behavior (high bar at Hour 0).
- **Efficiency Scatter:** Active Presses vs. Infusions (to identify motivation vs. habit).

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4. Technical Logic (How It Works)

The analyzer uses a **Scalar-Priority** logic engine to ensure accuracy across decades of data formats:

1. **Scan:** The script reads the raw text file line-by-line.

2. **Detect:** It looks for variables defined in the MSN protocol.
3. **Priority Check:**
    - **Step A (Scalar):** Does a single value exist? (e.g., A: 150). If yes, use 150.
    - **Step B (Array):** If no Scalar, does an Array exist? (e.g., A: 0: 10.2 20.5). If yes, sum all values in the array.
    - **Step C (Default):** If neither exists, the value is set to 0.
4. **Normalize:** All durations are converted to seconds automatically based on the file's metadata tags.

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5. Advanced Configuration

The app comes pre-loaded with standard Lynch Lab protocols (FR, PR, Extinction, Fentanyl, etc.). To analyze a **new or custom protocol** without waiting for a software update:

1. Create a file named Settings.json in your data folder.
2. Define your protocol structure (see example below).
3. Run the app. It will detect the file and log **"⚙️ Loaded Settings.json"**.

Example Settings.json:

JSON

```
{
  "msn_patterns": {
    "MY NEW EXPERIMENT": ["new_msn_code_v1"]
  },
  "variable_mappings": {
    "MY NEW EXPERIMENT": {
      "infusions": ["I"],
      "active_presses": ["R"],
      "duration": "Z",
      "extra_vars": ["W"]
    }
  }
}
```

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6. Publication & Methods

How to Cite this Tool in Manuscripts:

> "Raw behavioral data were processed using the **Lynch Lab MedPC Analyzer (v4.6)**, a custom Python-based software pipeline. The software utilizes a scalar-priority parsing engine to standardize data extraction across varying MedPC protocols. Event timestamps were aggregated into hourly bins for micro-structural analysis, and session totals were calculated to monitor daily trajectories. Visualizations were generated automatically using the Seaborn and Matplotlib libraries."

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7. Troubleshooting

Issue	Probable Cause	Solution
"No data matched your ID list"	ID Mismatch or Wrong Folder	1. Check that the IDs in ids.txt match the Subject: line in the raw files exactly. 2. Ensure raw files start with !.
"Variable Mismatch" / Zeros	Parsing Error	The app might be looking for an Array when your data is a Scalar. The new **v4.6** engine fixes this automatically. Update your app to the latest version.
"Mac App won't open"	Apple Security	Right-click the App icon -> Select **Open** -> Click **Open** in the popup.
Excel file won't save	File Open	Close the Excel file if you have it open in Microsoft Excel, then try running the app again.

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8. Support & Contact

Report Issues:

If you encounter a bug or need a new protocol added permanently to the default list, please contact the developer.

- **Developer:** Greatness Olaitan
- **Email:** [Insert Email]
- **Lab Location:** [Insert Lab Location]

Demo Data:

A folder named Example_Data is included in the repository. Use this to test the app if you do not have your own files yet.
