# asc2csv: A Python Package for Eye-Tracking Data Conversion

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## I. Introduction

Vision is one of the most critical senses, playing a fundamental role in perceiving and interpreting the world around us [1]. Beyond simple perception, vision is integral to communication, learning, and interaction [2]. We interpret non-verbal cues through visual input, gain spatial awareness, and navigate our environment safely and efficiently [3].

Research on vision aims to uncover the complex mechanisms underlying sight and to address various conditions that impair it. Advances in this field can lead to innovative treatments for eye diseases such as macular degeneration, glaucoma, and diabetic retinopathy, significantly improving the quality of life for affected individuals [1]. Moreover, insights from vision research contribute to designing better assistive devices, enhancing independence for visually impaired individuals.

Recording eye movements is a key component of vision research. It involves capturing and analyzing how individuals look at visual stimuli [4], [5], [6]. Eye movement data is vital across various domains, from psychology to user experience design, as it reveals insights into attention, perception, and cognitive processes.

## II. Eye Tracking Technologies

Eye tracking is a primary technology for recording eye movements. Eye trackers are typically classified into screen-based and wearable systems, like those from SR Research's EyeLink; screen-based systems are ideal for controlled laboratory settings. These devices use infrared light and high-speed cameras to achieve high precision. Wearable trackers, resembling glasses with embedded cameras, are designed for naturalistic settings such as sports performance studies. Other methods, like electrooculography (EOG) [7] and video oculography (VOG) [8], provide alternatives for specific applications, though they differ in precision and use cases. The EyeLink eye tracker supports various research contexts, offering real-time data with spatial resolutions as satisfactory as $0.25^\circ$ of visual angle and sampling rates up to 1000 Hz. These features make it indispensable in psychology, neuroscience, human-computer interaction, and market research.

## III. Challenges with EDF and ASC Formats

Data collected by EyeLink systems are stored in EDF (binary) and ASC (ASCII) formats. While EDF files contain rich raw data, they require extensive preprocessing to be usable. Similarly, ASC files, though human-readable, demand significant effort to structure and parse the raw time-stamped and event-driven data. This complexity often hinders straightforward analysis, especially for researchers lacking programming expertise.

For advanced statistical analysis, this lack of structure presents additional challenges. The raw data must be transformed into a tabular format like CSV to enable efficient processing and analysis. This conversion process involves handling noise, missing data, and recording irregularities.

## IV. The ASC2CSV Python Package

The `ASC2CSV` Python package simplifies the conversion of EyeLink ASC files to CSV format, addressing the challenges of preprocessing and structuring data. By providing a standardized tabular output, the Package enhances accessibility and usability for machine learning and statistical workflows.

This conversion is significant in machine learning workflows, where large volumes of clean, structured data are required to train. Ford validates models. With the CSV format, the data can be easily integrated into standard machine learning pipelines, enabling the use of automated techniques for feature selection, pattern recognition, and predictive modelling. Additionally, CSV files can be easily shared and opened across different platforms and tools, enhancing collaboration and the reproducibility of results.

### A. Installation

The package can be installed from the Python Package Index (PyPI) using the following command:

```
pip install asc2csv
```

### B. Preparing EyeLink Data

Before using `ASC2CSV`, convert EDF files to ASC format using EyeLink's `edf2asc` tool. Additionally, messages like `TRIALID` can be embedded in experimental scripts for better data organization:

```
el_tracker.sendMessage(f"TRIALID
    ↪ {trial_num}")
el_tracker.sendMessage("Custom Message")
```

it is necessary to convert data correctly for reference, please take a look at Figure 1

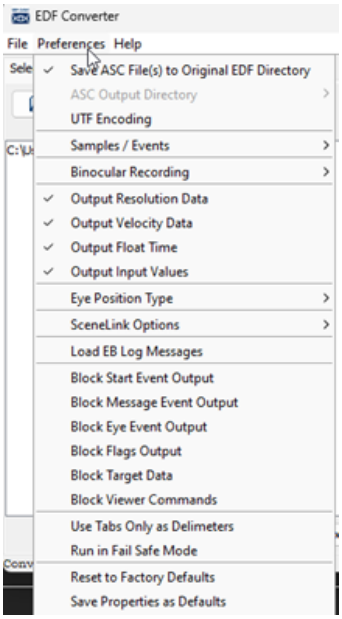


Fig. 1. Using EDF2ASC convertor

### C. Conversion to CSV

Once the ASC file is prepared, use the following commands to convert it to CSV:

```
import asc2csv as convert
convert.process_asc_file('input.asc',
↪  'output.csv')
```

This process may take time, depending on the data size. The resulting CSV file is compatible with various data analysis tools.

## V. Conclusion

The `ASC2CSV` package bridges the gap between EyeLink data formats and analysis-ready structures, enabling researchers to focus on extracting meaningful insights rather than preprocessing raw data. Its integration with Python enhances flexibility and efficiency for researchers across disciplines.

## VI. Acknowledgement

This Package is part of PhD project and has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 101034319 and from the European Union – NextGenerationEU.

Project Codes, including Python codes used to convert, are FREELY available and accessible in this Github Repository and are licensed under MIT License.

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