



SLAP: SLID Arrival Picker GUI to Help Seismic Analysts Detect Event Onset Times

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Background

- Seismic analysis requires human expertise to identify seismic waves embedded in background noise
- Seismic analysis is important for tasks such as monitoring whether an event was normal seismic activity or a nuclear test
- One waveform has to go through 3 different analysts to detect and refine the event onset time

Goal

Use data science techniques to improve analysts' speed and accuracy in detecting event onset times

Approach

- Apply compression algorithms to seismic data to assess the information content of the waveforms
- Create a graphical user interface that can pull an event from the IRIS website, plot it with SLID and UQ analysis, and save the time picks that an analyst makes

Method

Sliding Information Distance (SLID):

- Builds off the Lempel Ziv Jaccard Distance (LZJD)
- Convert waveform into a string of tokens and represent them as a range of integers
- Builds a probability model of each token based on prior patterns. If the model is correct for a new input, the information can be compressed more
- SLID indicates how similar two things are, which is useful for comparing the time period before and after an event onset in a seismic waveform

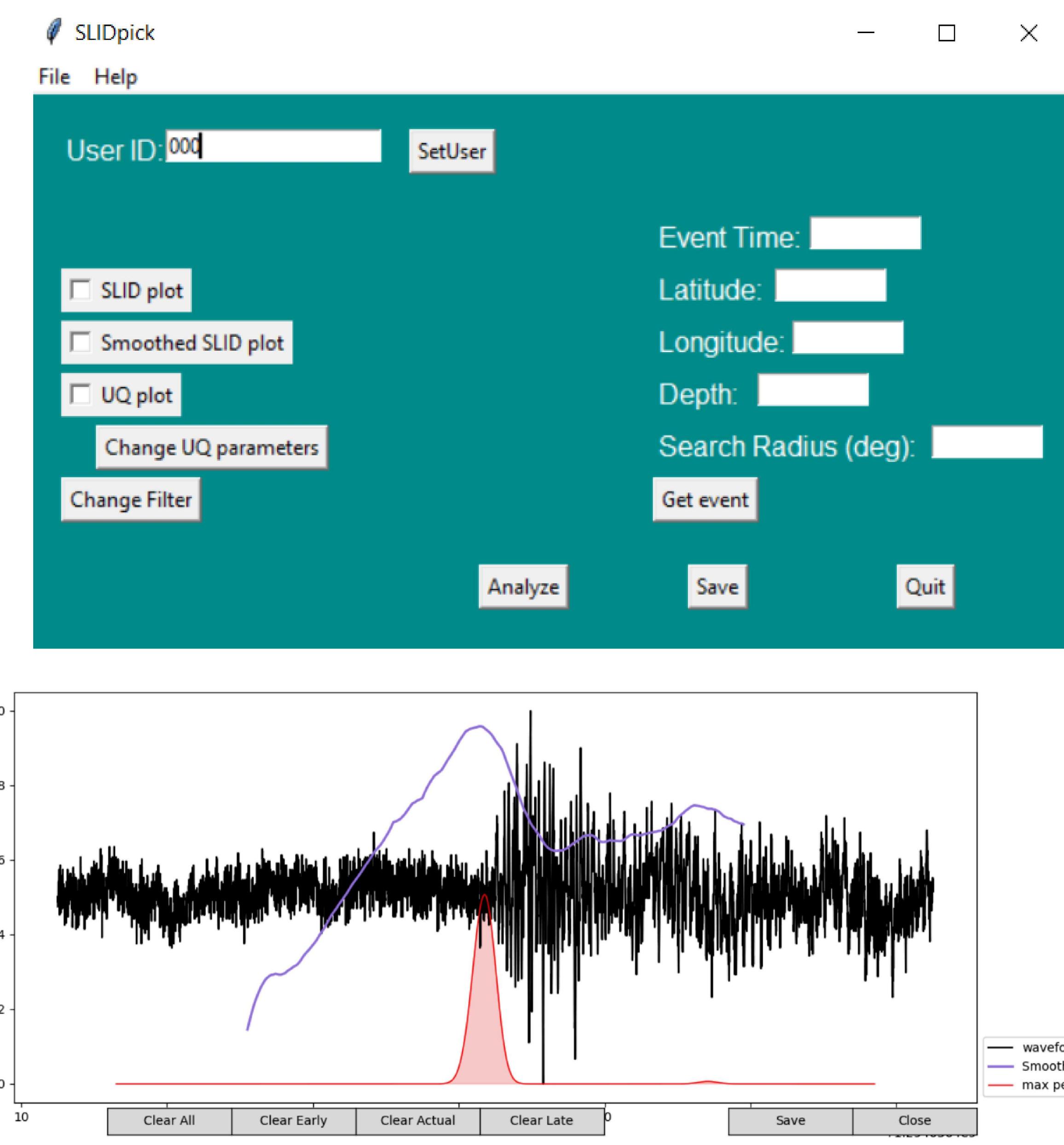
Uncertainty Quantification (UQ):

- To assess the confidence in our SLID prediction of the event onset time, t^*
- Draw $n = 100$ random samples from parameters and run SLID with peak merging for each sample, producing n predictions of t^*
- Parameters: `windowSize`, `smoothingWindow`, `minDipSize`, `minPeakSize`, `maxSep`
- Plot the resulting PDF fitted with a Gaussian KDE

SLAP GUI

- SLID Arrival Picker
- GUI that can integrate SLID and UQ analysis to assist seismic analysts
- Can save analysts' time and effort with picking event onset times

Results



Future Work

- Pull event data from seismic networks through IRIS website
- Option to filter waveform data
- Testing different visualizations of the SLID information with analysts