



# 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

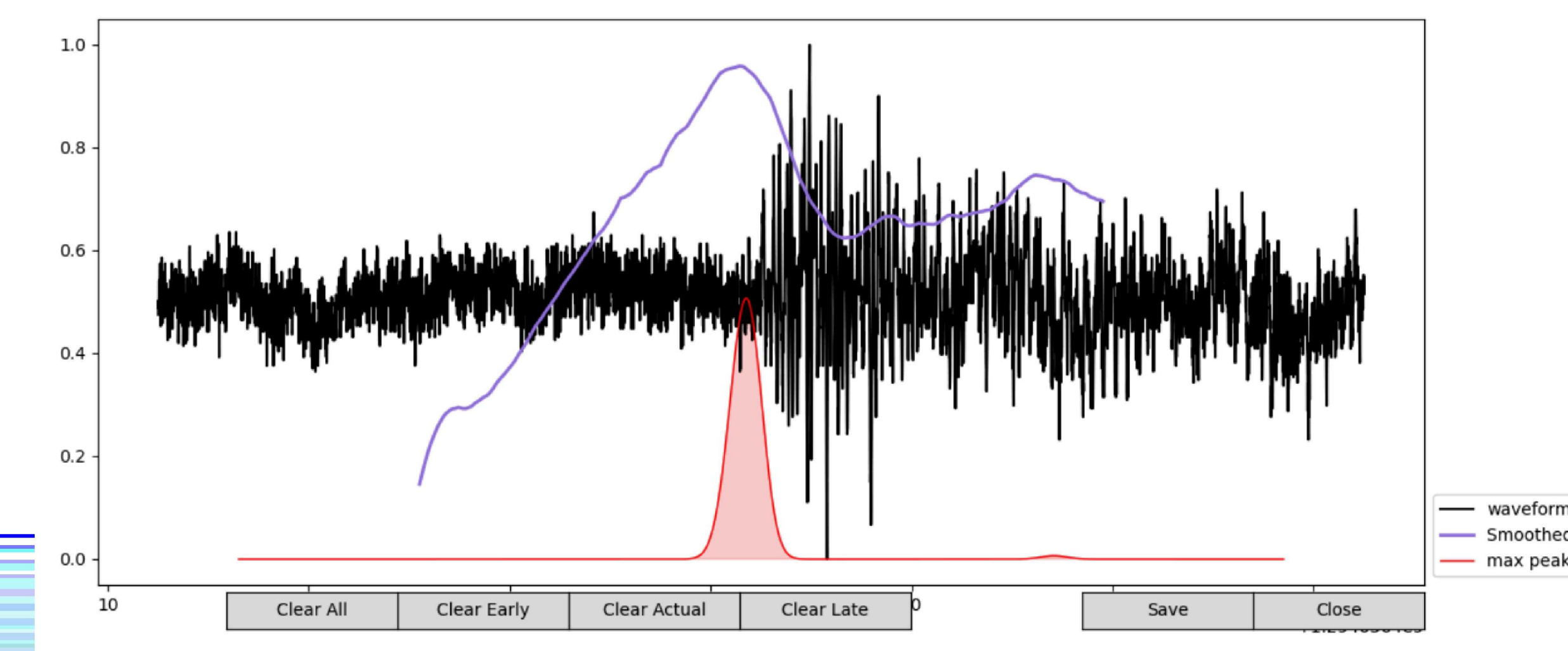
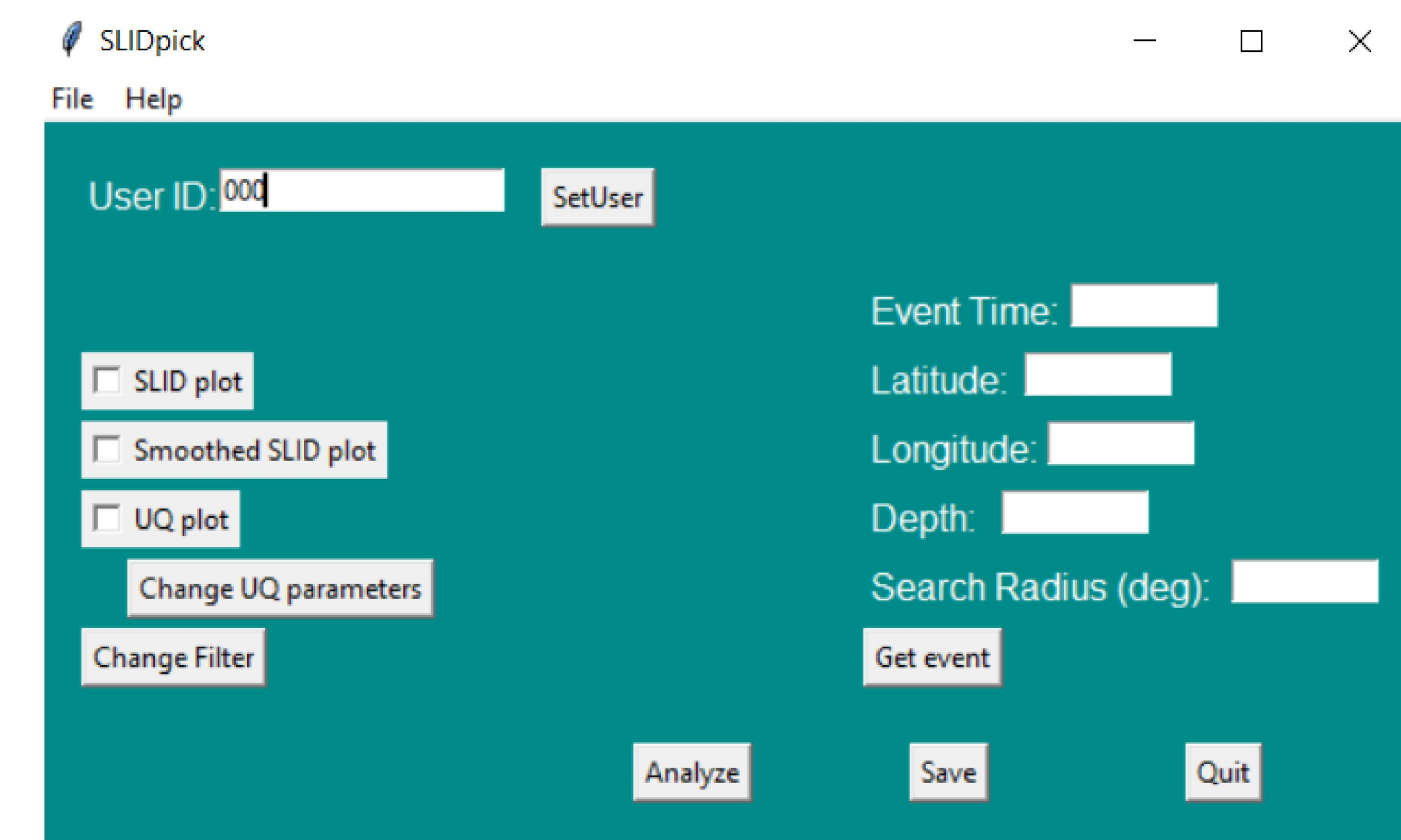
### Uncertainty Quantification (UQ):

- 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