A free, open-source collection of Python 3.x methods for high-throughput quantitative analysis of ultrasound imaging data.

- We focus on lingual and laryngeal ultrasound here, but our methods are adaptable to any 2D grayscale image data (video, MRI, in theory).
- Designed to work with AAA raw scanline data: large user base ready for development.

Our initial focus is on non-contour methods for ultrasound analysis.

- Automatic tongue surface contour extraction (e.g., [13]), revealing accurately.
- But not the only approach, or even a suitable approach, for all data types or research questions.

### Pixel difference

Euclidean distance in terms of pixel intensity between pairs of images:

- Captures change over entire image: surface contours but also internal musculature.
- SATKIT implements two pixel difference methods from Palo [10]:
  - Whole-image method: calculates PD over all matched pixels in a pair of images.
  - Scanline-based method: calculates PD for each column of pixels (more localised).

Among other things, well-suited to locating onset of articulation.

### Optical flow

Characterizes direction and magnitude of apparent motion between pairs of frames:

- Especially well suited to laryngeal data (no single surface to track).
- SATKIT implements method similar to Moisik et al. [9], but using dense optical flow, resulting in a flow field (one flow vector per pixel).
- Consensus vectors obtained by averaging entire fields or regions of interest, can be decomposed into horizontal and vertical components.
- Displacement can be estimated from cumulative integration of velocity signal.

### Dimensionality reduction

Discovers important, orthogonal dimensions of variation in a data set, patterns of covariation in pixel brightness [5, 6, 7, 3].

- SATKIT uses principal component analysis (PCA) from scikit-learn [11].
- Utilizes to support:
  - Filtering and applying region of interest masks.
  - Reshaping and rescaling to eigen-gram [8] or eigenarygrams, which help with interpretation of PCs.
- Linear discriminant analysis (LDA) can be used to generate time-varying articulatory signals from PCs, l. a. [8, 12].

Mandarin /r/–/ŋ/ contrast (see above data) from Faytk et al. [2].

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Poster PDF with references.
References


