**Research Project: Real-time Visualization of Speech**

**Context:** When learning a foreign language, pronunciation is very important. However, training to improve pronunciation can be very difficult and time-consuming. A novel way to do this is by using advanced training programs which monitor and compare the physical motion of lips and tongue, and correlate that with the obtained pronunciation.

**Application:** To this end, the Department of Computational Linguistics has developed an application for interactive training of pronunciation in foreign languages. The application works in two modes. First, it allows users (students of foreign languages) to visually monitor an audio representation of their speech, and compare it with pre-recorded audio representations of pronunciations by other native and non-native speakers. Secondly, the application monitors the lip and tongue motion during speech in real-time, and provides visual feedback on this motion.

**Extension:** To improve this procedure, an extended application needs to be constructed (based on the current one) in which the trainees can monitor, in real time

- how their pronunciation differs from the one of other pre-recorded speakers
- how the motion of their lip and tongue differs from the one of other pre-recorded speakers

Additionally, the application should allow off-line comparison of pre-recorded speech-and-motion sequences. Such sequences are already available for the project.

To get a quick idea about the current application, see the following video:


To this end, novel abstract visualization methods should be designed which will emphasize the similarities and differences, in time and space, of speech fragments. Apart from this, enhancements to the preprocessing of the speech-and-motion data need to be executed, to allow for its real-time analysis and comparison with other pre-recorded sequences. As such, the project lies at the crossroads of data visualization, information visualization, interactive systems, and audio processing.

**Embedding:** The candidate will work under the co-supervision of dr. Martijn Wieling (wieling@gmail.com) from the Department of Computational Linguistics, and prof. dr. Alex Telea (a.c.telea@rug.nl) from the Scientific Visualization and Computer Graphics group, Johann Bernoulli Institute. For more technical details, please contact dr. Wieling.

**Candidates:** Suitable candidates should have (very) good programming experience with Matlab, and preferably skills in 2D and 3D computer graphics and data visualization. The project can be scaled to match a MSc research internship, BSc thesis, or MSc thesis. If interested in the project, please contact dr. Wieling and prof. Telea.