VOICE ANALYSIS TOOLBOX

Version 1, 7 March 2014

Use of the toolbox

Simply run "voice_analysis_toolbox.m". You should provide either (a) a '*.wav' file or (b) the sustained vowel signal 'data' and the sampling frequency 'fs' as inputs into the function. Ideally, high quality speech signals should be used (e.g. with sampling frequency of 24 kHz). Indicative use:
(a) [features, feature_names] = voice_analysis.toolbox('thanasis_aahh.wav')
(b) [features, feature_names] = voice_analysis.toolbox(data_signal, 24000)

The first output of the function, 'features' can be directly presented to your favourite machine learning algorithm for mapping the extracted characteristics from speech onto your response (which is obtained independently, e.g. provided by experts). The second output of the function, 'feature_names' succinctly summarizes the feature (please refer to my DPhil thesis for algorithmic details).

Downloading necessary third party software & SETUP

Before using the Voice Analysis Toolbox, you will need to download software from other researchers (third party software). I apologise in advance for complicating the user's task, but this is an easier way to adhere to different licence issues. **To facilitate this process, I have included the function "setup_voice_analysis_toolbox" which the user should run on a machine which is connected on the Internet to download the required files.** If the authors of the third party software move their functions, the user may have to manually download the required functions from the authors'/developers' websites.

For simplicity I suggest including the downloaded files/folders within the folder of the Voice Analysis Toolbox (then my function will automatically include all functions in the subfolders within the Voice Analysis Toolbox automatically in Matlab's path, otherwise the user will need to do this manually). If some functions are not downloaded, the features that rely on third-party functions will not be calculated, and will be denoted by 'NaN' in the resulting feature vector. Specifically, you will need to download (and unzip where necessary):

1) VoiceBOX: www.ee.ic.ac.uk/hp/staff/dmb/voicebox/voicebox.zip
2) EMD code: http://perso.ens-lyon.fr/patrick.flandrin/pack_emd.zip
3) SHRP F0 estimation algorithm:
http://www.mathworks.co.uk/matlabcentral/fileexchange/downloads/4441/download
4) SWIPE F0 estimation algorithm: http://www.cise.ufl.edu/~acamacho/publications/swipep.m
5) DFA: www.maxlittle.net/software/fastdfa.zip
6) RPDE: www.maxlittle.net/software/rpde.zip

It is important to note that the toolbox will work even if these functions are not present in Matlab's path. The corresponding algorithmic measures will then be denoted by NaN values instead of scalar values.

More details about the algorithms used in the toolbox

The toolbox contains functions developed over a series of papers in the last few years. The main research studies for which this toolbox was developed appear below in order of decreasing importance:

[1] A. Tsanas, M.A. Little, P.E. McSharry, L.O. Ramig: "Nonlinear speech analysis algorithms mapped to a standard metric achieve clinically useful quantification of average Parkinson's disease symptom severity", *Journal of the Royal Society Interface*, Vol. 8, pp. 842-855, 2011

[2] A. Tsanas, *Accurate telemonitoring of Parkinson's disease symptom severity using nonlinear speech signal processing and statistical machine learning,* D.Phil. (Ph.D.) thesis, University of Oxford, UK, 2012

[3] A. Tsanas, M.A. Little, P.E. McSharry, L.O. Ramig: "New nonlinear markers and insights into speech signal degradation for effective tracking of Parkinson's disease symptom severity", *International Symposium on Nonlinear Theory and its Applications* (NOLTA), pp. 457-460, Krakow, Poland, 5-8 September 2010

[4] A. Tsanas, M.A. Little, P.E. McSharry, L.O. Ramig: "Enhanced classical dysphonia measures and sparse regression for telemonitoring of Parkinson's disease progression", *IEEE Signal*

Processing Society, International Conference on Acoustics, Speech and Signal Processing (ICASSP), pp. 594-597, Dallas, Texas, US, 14-19 March 2010

[5] A. Tsanas: "Automatic objective biomarkers of neurodegenerative disorders using nonlinear speech signal processing tools", *8th International Workshop on Models and Analysis of Vocal Emissions for Biomedical Applications* (MAVEBA), pp. 37-40, Florence, Italy, 16-18 December 2013

Citation request

If you use this toolbox in your research, please include the following citations:

[1] A. Tsanas, M.A. Little, P.E. McSharry, L.O. Ramig: "Nonlinear speech analysis algorithms mapped to a standard metric achieve clinically useful quantification of average Parkinson's disease symptom severity", *Journal of the Royal Society Interface*, Vol. 8, pp. 842-855, 2011

[2] A. Tsanas, *Accurate telemonitoring of Parkinson's disease symptom severity using nonlinear speech signal processing and statistical machine learning,* D.Phil. (Ph.D.) thesis, University of Oxford, UK, 2012

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