Surface EMGs Features to Differentiate between Saliva and Water Based on Single Swallowing Events.

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The incontrovertible fact which our society is facing nowadays is the increase in population aged 65 and over. According to a UN source (2019), by 2050 one in six people in the world will be aged over 65, and the number of persons aged 80 years and over to triple. While this is due to societal improvements in lifestyle and advances in technology and healthcare, it will soon pose new challenges if action is not taken to advance the technology we currently possess as elders necessitate more care and medications. One such flaw in our healthcare system is posed by dehydration, which particularly concerns older adults. With the vision of an automatic fluid monitoring system, this study investigates features of the surface EMG (sEMG) that can be used to discriminate saliva from fluid intake.

The sEMG signals for both suprahyoid and infrahyoid group of 11 subjects (3 females, 8 males, mean age 27±13.42) were recorded. Subjects were instructed upon command to perform three saliva swallows, five sips from a cup, straw, plastic bottle and a sip of water with volume equal to the largest volume being swallowed with an additional 5 ml. Weights of the containers were recorded before and at the end of each sip to enable the calculation of the amount of fluid being swallowed during each recording. The sequence of the tasks was randomised for each subject. Recordings were then processed in MATLAB®. A bandpass filter with a bandpass frequency range of 20-400 Hz was applied to eliminate components which do not hold significant anatomical information and a Teager-Kaiser Energy Operator (TKEO) which allowed to identify and differentiate between segments of the signal containing swallowing bursts and noise. Four features were then applied to the burst and noise segments, namely Root Mean Square (RMS), Mean Absolute Value (MAV), Waveform Length (WL) and Willison Amplitude (WAMP). Principal Component Analysis (PCA) using the singular value decomposition algorithm was then applied to such features.

Using the first two principal components, applied to each subject, there is a clear difference between noise, saliva and water (Fig 1). This holds for most of the subjects thus providing the potential of an optimum classifier.

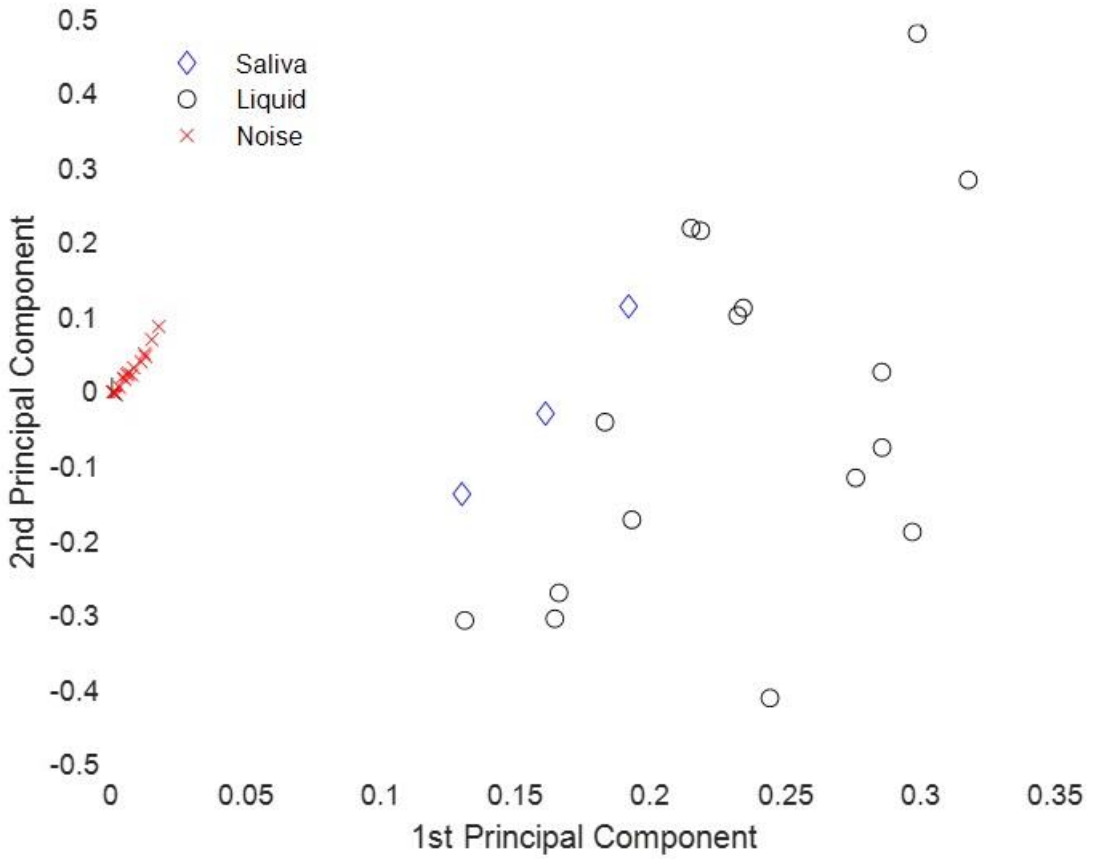

Figure 1: *Graph showing the two principal components for noise, water (liquid) and saliva for one subject.*

References:

United Nations, Department of Economics and Social Affairs (2019). World Population Prospects [online]. *United Nations.* [Viewed 21 November 2019]. Available from: https://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html