Feature Identification for Texture description from Tactile Sensors

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Abstract

This paper describes an experiment to quantify texture using an artificial finger equipped with a microphone to detect frictional sound. Artificial surfaces were created to constrain the subsequent analysis to specific textures. Recordings of the artificial surfaces were made to create a library of frictional sounds for data analysis. These recordings were mapped to the frequency domain using Fast Fourier Transforms for direct comparison, manipulation and quantifiable analysis. Numerical features such as modal frequency and average value were calculated to analyse the data and compared with attributes generated from Principal Component Analysis (PCA). It was found that numerical features work well for highly constrained data but cannot classify multiple textural elements. Principal Component Analysis was performed on the Fast Fourier Transforms of the recorded textural data. From this it is shown that PCA groups the textures according to a natural similarity, and uses all of the numerical features in its analysis. Clustering of the PCA data shows that similar discs are grouped together with few classification errors. In contrast clustering of numerical features produces erroneous classification by splitting discs between clusters.