TITLE
An information-theoretical study of speech processing in the peripheral auditory system and cochlear nucleus: application to the recognition of French voices stop consonants

ABSTRACT
In this study we use classical tools from statistical pattern recognition and communication theory to investigate the role of the first auditory brain centre, the cochlear nucleus, in speech recognition. We start with a brief introduction to the anatomy and physiology of the peripheral auditory system and cochlear nucleus. This is followed by a survey of relevant pattern recognition, information processing and neural networks theory, bringing together a number of important results from linear and non-linear least squares analysis. We then hypothesise that Onset and Offset responses in the cochlear nucleus could be used to locate plosive information concentrations in order to focus higher level plosive recognition on optimal regions in the spectro-temporal distribution of discharge in the auditory nerve fibres. To test this hypothesis we develop a technique based on Shannon's measure of mutual information to obtain the distribution across the auditory spectrogram, relative to both onset and offset positions, of information for plosive recognition in vowel-plosive-vowel context. We find that both Offset (consonantal closure) and Onset (consonantal explosion) are strongly associated with plosive information peaks, although a substantial proportion of this information exists in a distributed form which requires both spectral and temporal integration.

KEYWORDS
Neural networks, multi-layer perceptrons, phoneme recognition, mutual information, entropy estimation, cochlear nucleus, onset and offset responses, data reduction.

This thesis is also available in French.