

Filter Bank Design for Melody Recognition

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Abstract

Recognizing different features of a waveform to later recompose the music that was originally present in the signal is a difficult task. There are numerous fields of application where these techniques are known to be useful including music authoring, digitizer design, automatic music transcription. There are many different methods that can be used for this purpose giving somehow inadequate quality regarding noise, polyphony or time- / frequency localization compared to the human auditory system. In this article, I will show a new filter design method specifically designed to be aware of human perception features. I will also show the way how a complete filter bank can be assembled and used for melody recognition in real time. Finally, I will point out the benefits of this filter design compared to other methods.

Keywords: DSP, melody recognition

1 Introduction

1.1 Main Objectives

Melody recognition is a process where different features are extracted from a waveform to later form music data. These features, such as *pitch*, *note length* and *loudness*, are high-level, subjective and abstract psychological perceptions [9] that are hard to deal with. Recognizing rhythm and melody simultaneously should involve an analyzation process both in time- and frequency domains [14]. This resolution should have special requirements compared to other conventional signal processing techniques. Examining these requirements makes us possible to reach superior quality over standard methods [1, 15, 20].

Time resolution must have an adequate *separation* property. Separation avoids blurring sounds together that were audible as two distinct notes. It should also give *continuity* in a way that it does not leave short but significant sounds out of processing. These requirements, together with their exact parameters, can be derived from psychoacoustic measurements [9].

The frequency resolution should fit the exponential *scale of music* [13]. It should give correct state information about every note along the scale regarding the note

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