Algorithms for Computing Approximate Repetitions in Musical Sequences

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Abstract. This talk will focus on a set of string pattern-matching problems which arise in music analysis and musical information retrieval. A musical score can be viewed as a string: at a very rudimentary level, the alphabet could simply be the set of notes in the chromatic or diatonic notation. Approximate repetitions in musical entities play a crucial role in finding musical similarities amongst different musical entities, as well as playing a part in defining the "characteristic signature". Such algorithms can be used for melody identification and music retrieval e.g. audio applications on Internet systems.

Here we introduce two new notions of approximate matching with application in computer assisted music analysis. Let Σ be an alphabet of integers. We say that two symbols a, b are δ-approximate, denoted $a =_\delta b$ if and only if

$$|a - b| \leq \delta$$

where δ is a given integer. We say that two strings x, y are δ-approximate, denoted $x =_\delta y$ if and only if

$$|x| = |y|, \text{ and } x_i =_\delta y_i, \ \forall i \in \{1..|x|\}$$

for a given integer δ. Furthermore we say that two strings x, y are γ-approximate, denoted $x =_\gamma y$ if and only if

$$|x| = |y|, \text{ and } \sum_{1}^{|x|} |x_i - y_i| < \gamma$$

for a given integer γ. Furthermore, we say that two strings x, y are $\{\gamma, \delta\}$-approximate, denoted $x =_{\{\gamma,\delta\}} y$, if and only if x and y are both γ and δ approximate.

We will present algorithms for δ–approximate string matching, $\{\gamma, \delta\}$–approximate string matching as well as for computing δ–approximate squares.