

Advanced Course Computer Science

Music Processing

Summer Term 2010

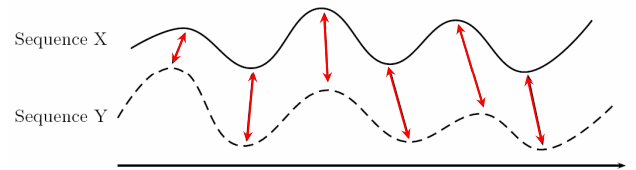
Meinard Müller

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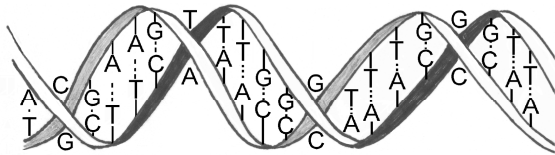
Dynamic Time Warping



Alignment

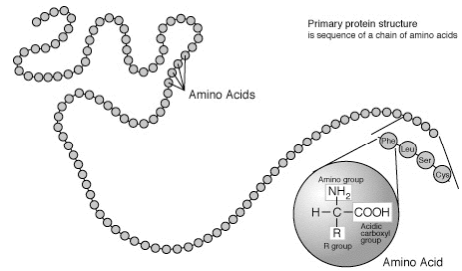


Alignment



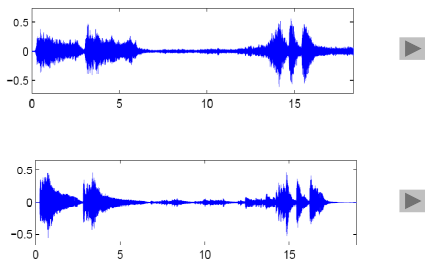
DNA = Sequence of Nucleotids

Alignment



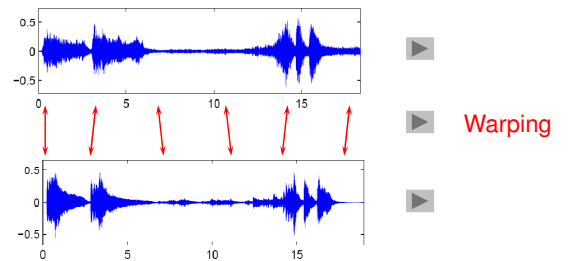
Protein = Sequence of Amino Acids

Alignment



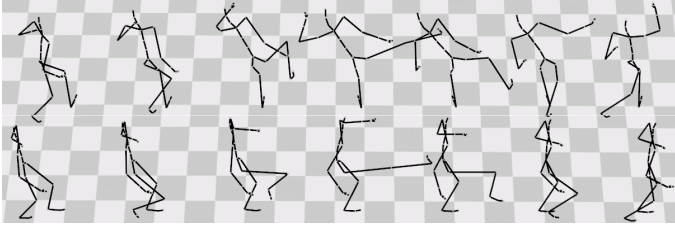
Music = Sequence of Audio Samples

Alignment



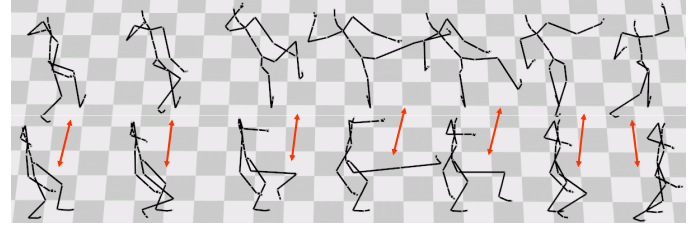
Music = Sequence of Audio Samples

Alignment



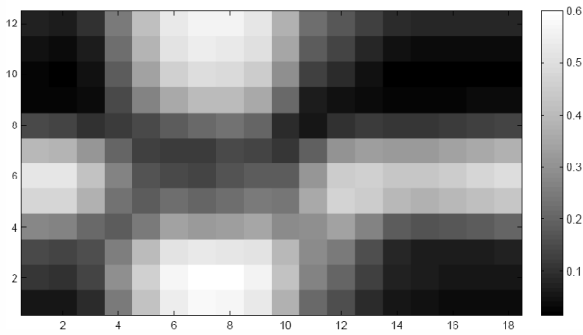
Motion = Sequence of Poses

Alignment



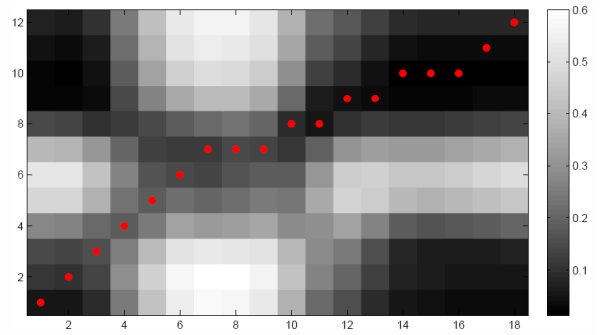
Motion = Sequence of Poses

Cost Matrix

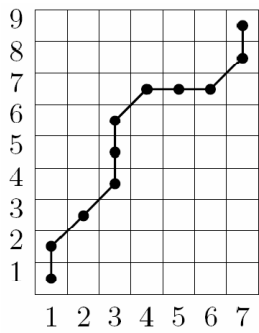


Cost Matrix

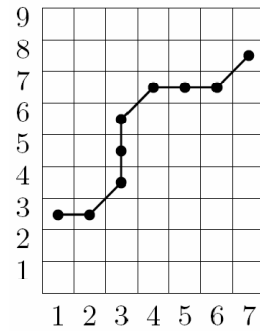
Cost-minimizing warping path



Warping Path

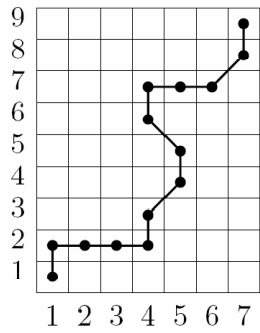


Warping Path



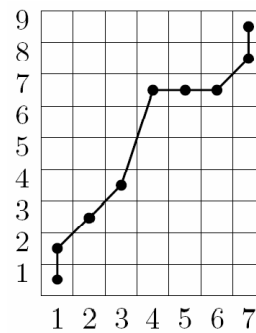
Violation of Boundary Condition

Warping Path



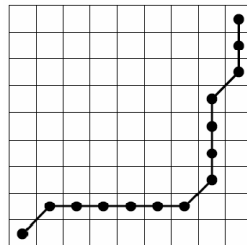
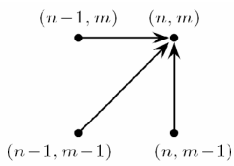
Violation of Monotonicity Condition

Warping Path

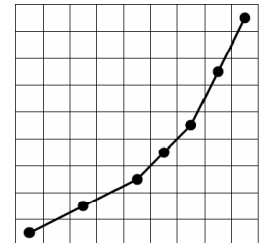
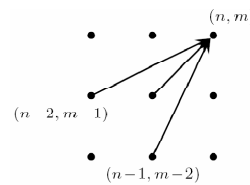


Violation of Step Size Condition

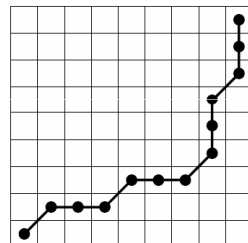
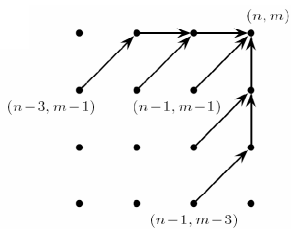
Variation of Step Size Condition



Variation of Step Size Condition

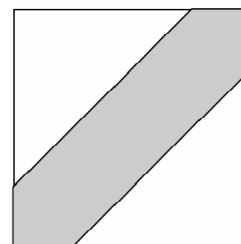


Variation of Step Size Condition

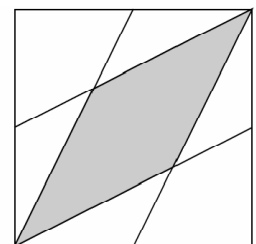


Strategy: Global Constraints

Sakoe-Chiba band

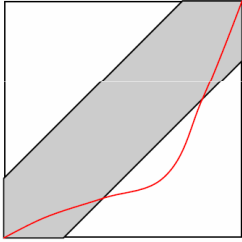


Itakura parallelogram

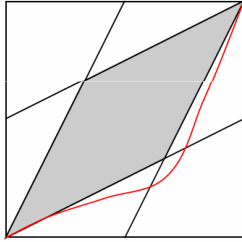


Strategy: Global Constraints

Sakoe-Chiba band

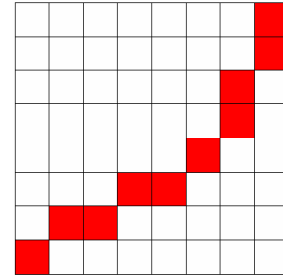


Itakura parallelogram



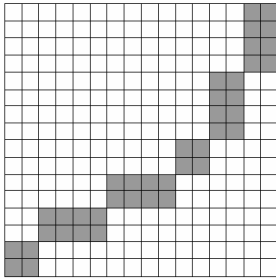
Problem: Optimal warping path not in constraint region

Strategy: Multiscale Approach



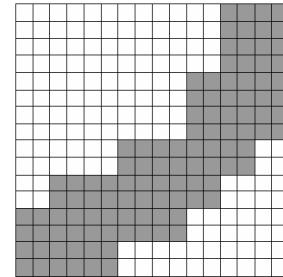
Compute optimal warping path on coarse level

Strategy: Multiscale Approach



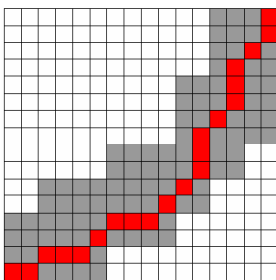
Project on fine level

Strategy: Multiscale Approach



Specify constraint region

Strategy: Multiscale Approach



Compute *constrained* optimal warping path

Subsequence DTW

