

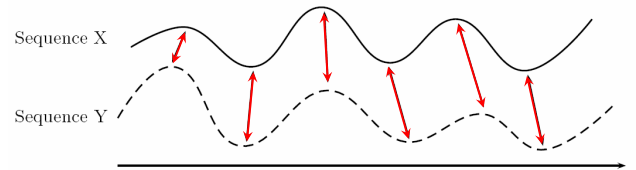
Lecture
Information Retrieval for Music and Motion

Meinard Müller
 Summer Term 2008

Dynamic Time Warping



Alignment

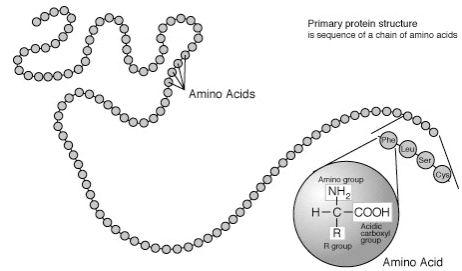


Alignment



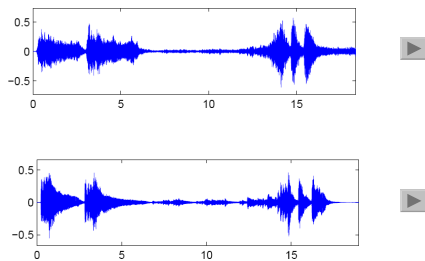
DNA = Sequence of Nucleotids

Alignment



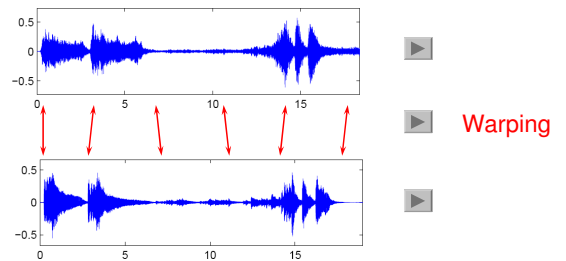
Protein = Sequence of Amino Acids

Alignment



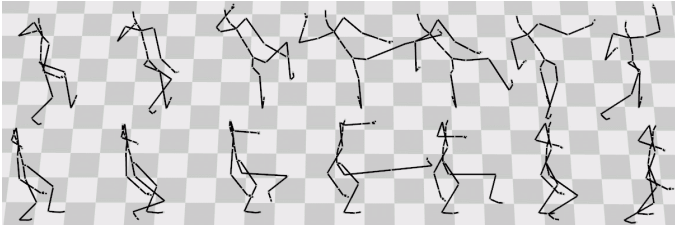
Music = Sequence of Audio Samples

Alignment



Music = Sequence of Audio Samples

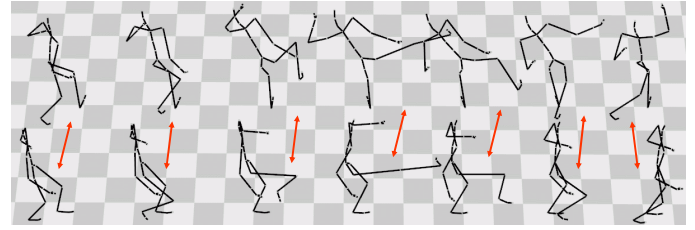
Alignment



Motion = Sequence of Poses

7

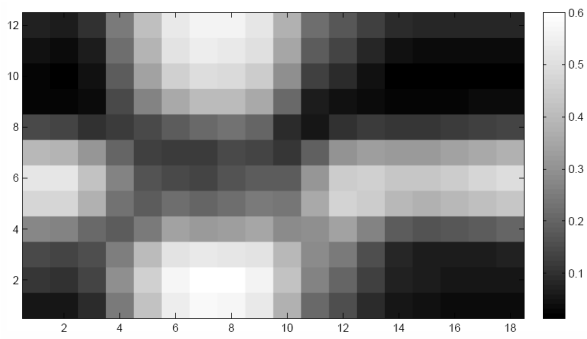
Alignment



Motion = Sequence of Poses

8

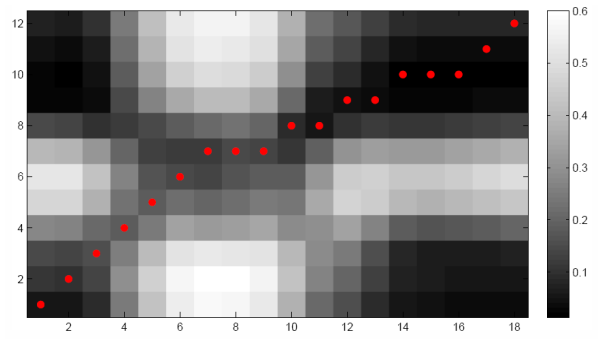
Cost Matrix



9

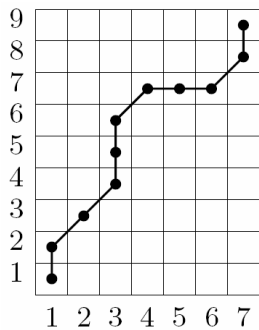
Cost Matrix

Cost-minimizing warping path



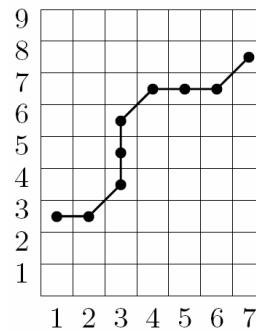
10

Warping Path



11

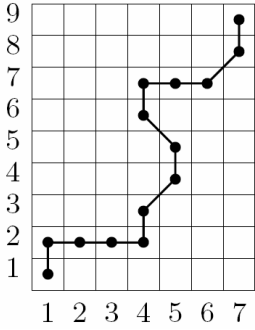
Warping Path



Violation of
Boundary Condition

12

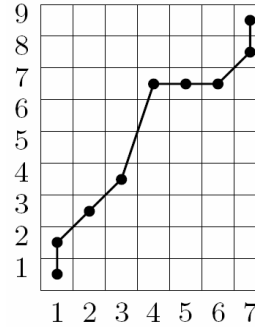
Warping Path



Violation of Monotonicity Condition

13

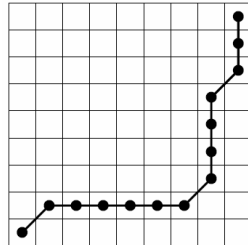
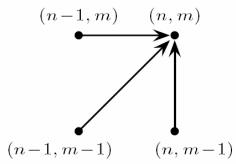
Warping Path



Violation of Step Size Condition

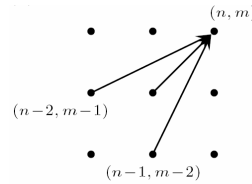
14

Variation of Step Size Condition



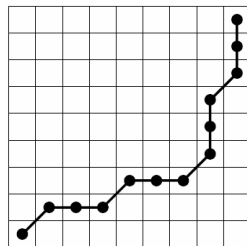
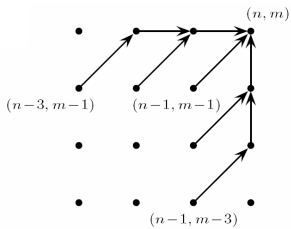
15

Variation of Step Size Condition



16

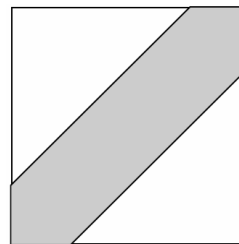
Variation of Step Size Condition



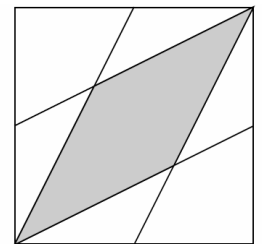
17

Strategy: Global Constraints

Sakoe-Chiba band



Itakura parallelogram

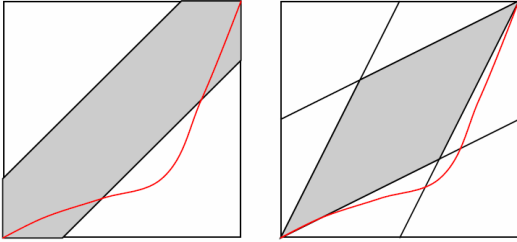


18

Strategy: Global Constraints

Sakoe-Chiba band

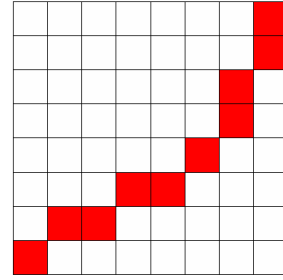
Itakura parallelogram



Problem: Optimal warping path not in constraint region

19

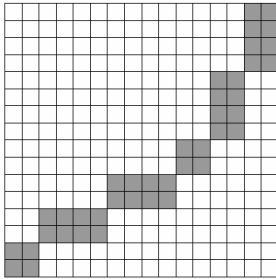
Strategy: Multiscale Approach



Compute optimal warping path on coarse level

20

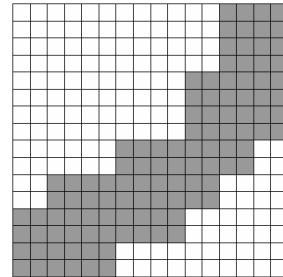
Strategy: Multiscale Approach



Project on fine level

21

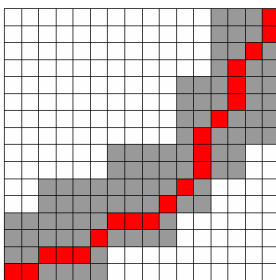
Strategy: Multiscale Approach



Specify constraint region

22

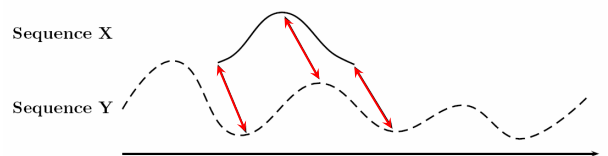
Strategy: Multiscale Approach



Compute *constrained* optimal warping path

23

Subsequence DTW



24