Chaotic Invariants for Human Action Recognition

Saad Ali, Arslan Basharat, Mubarak Shah
Computer Vision Lab, University of Central Florida

Our Contributions …
1) Investigation of the appropriateness of theory of chaotic systems for human action modeling and recognition.
2) Experimental validation of the feasibility and potential merits of carrying out action recognition using methods from theory of chaotic systems.

Proposed Idea …
\[
\left(\theta^1, \theta^2, \ldots, \theta^n\right)
\]

Function that maps current state to the next state.

Phase Space Embedding …
Underlying Idea: All variables of the system influence each other.

\[
\theta^1, \theta^{1+\tau}, \theta^{1+2\tau}, \ldots, \theta^{1+\left(m-1\right)\tau}
\]
ge generates a phase space that has exactly the same properties as the original/true variables of the system.

EmbeddingDelay & Embedding Dimension …
\[
\tau \cdot : \text{Mutual information between } \theta^{1+\tau} \text{ and } \theta^{1+\tau}
\]

Results …

Chaotic Invariants …
Lyapunov Exponent: Dynamical invariant which measures the divergence of nearby trajectories in the phase space.

Correlation Integral: Metric invariant which measures the percentage of points within a specific neighborhood averaged over entire phase space.

Correlation Dimension: Metric invariant which changes in the density of phase space with respect to neighborhood radius.

Algorithmic Overview …