FAST NON-LINEAR METHODS FOR DYNAMIC TEXTURE PREDICTION

S. Katcho, P. Turaga, A. Spanias, C. Tepedelenlioglu

SenSIP Center, School of ECEE, Arizona State University

Motivation

Open problems in Dynamic Texture Synthesis
- Improved Computation Efficiency in Prediction;
- High Prediction Fidelity of the Predicted Frames;
- Avoiding residual parametric error;
- Applications in surveillance and weather prediction.

Project Aim

- Fast Dynamic Texture Prediction with improved/same visual quality.
- Using ML techniques with Dynamic Texture Videos.

Proposed Algorithm

- Phase Space Matrix.
  \[ E = \begin{bmatrix} e_1, e_2, \ldots, e_N \end{bmatrix} \in R^M \times \sum_i d_i \] where each \( e_t \) is a phase space point.
- Kernel Regression for Prediction.
  \[ e_{t+1} = F(e_t) = \frac{N(e_t)}{\sum_{k=1}^{N(e_t)} (x_{k+1} - x_k) w_k(e_t, x_k)} \]
  where \( x_k \in E \) is the \( k \)th nearest neighbor of \( e_t \) and \( w_k(e_t, x_k) \) are Nadaraya Watson weights [1,2].
- Locality Sensitive Hashing Method is used to improve the computation efficiency compared to Exhaustive Nearest Neighbor Methods [3,4].

Preliminary Results

- Predicted Frame Numbers: 100, 250, 400, 550 and 700 (horizontally)
- Classes: Boiling Water, Candle, Fire, Fountain, Sea (vertically)
- Around 780 frames predicted using 75 frames.

Applications

- Cloud Movement Prediction in Solar.
- Illustration on the left shows how the weather cam data can be used in Cloud Movement Prediction.

Ongoing and Planned Work

- Use LSTMs for bigger dynamic texture videos for learning Long Term Dependencies.
- Apply the proof-of-concept method to cloud movement prediction application.

References


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