Interactive Browsing System for Anomaly Video Surveillance

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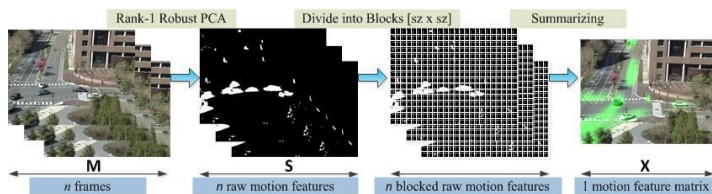Centre for Pattern Recognition and Data Analytics (PRaDA), Deakin University, Australia

MOTIVATION

❖ Lack of congruence between rare events detected by algorithms and what is considered anomalous by users.

❖ Recently introduced Rank-1 Robust PCA for background subtraction

❖ Limitation of Matrix Factorization is to specify number of cluster *a priori*.

❖ Bayesian Nonparametric Factor Analysis decompose data into a linear combination a sparse set of factors.

CONTRIBUTIONS

❖ Bayesian nonparametric Factor Analysis to estimate the latent movement factors of foreground properly.

❖ Introduce a novel framework for interactive examine anomaly events.

❖ The model assists user in spatial and spatial-temporal querying.

Feature Extraction

Rank-1 Robust PCA — Divide into Blocks [sz x sz] — Summarizing

M — *n frames* | S — *n raw motion features* | *n blocked raw motion features* | X — *1 motion feature matrix*

Examples of Extracted Features in Different Clips

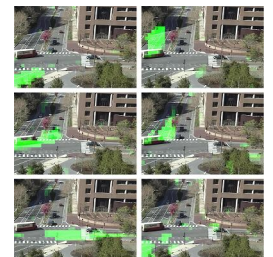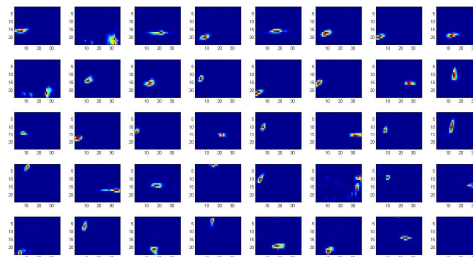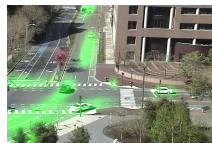## Bayesian Nonparametric Factor Analysis

Nonnegative Matrix Factorization
$$X_{[D \times N]} = W_{[D \times K]} \times H_{[K \times N]}$$
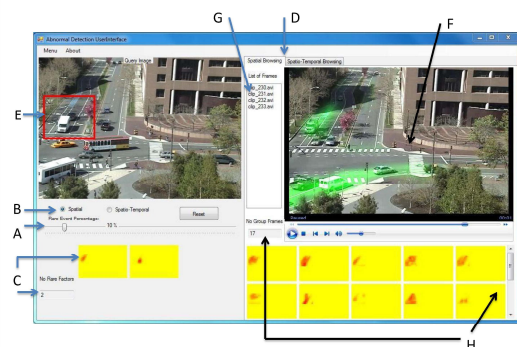
Bayesian Nonparametric Factor Analysis
$$X_{[D \times N]} = W_{[D \times K]}(Z_{[K \times N]} \odot F_{[K \times N]}) + E$$
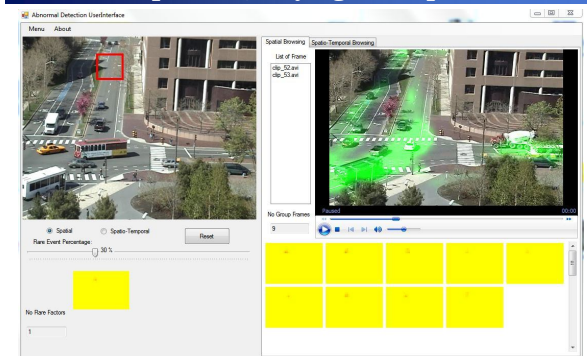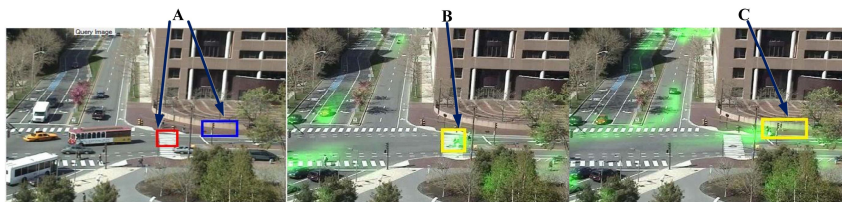$$X_i \mid W, Z_i, F_i \sim Poisson(W(Z_i \odot F_i) + \lambda)$$

User Interface

A: Adjusting level of rareness.
The indicator is displaying 10% of the total of events.

B: Two browsing schemes: spatial and spatio-temporal.

C: Latent factors detected using % of rare factors chosen.

D: Filtered output.

E: Spatially selected region.

F: Video clip matching filtered result.

G: List of clips containing latent factors.

H: Number of consecutive frames.

Spatial Querying Example

Example of Spatial-temporal Interactively Browsing

A: user drags two rectangles to search which events in red one followed by the blue one   **B**, **C**: detected frame corresponding in red/blue region

Another example of Fail Detection