Janus Shooting Event Detection

**Introduction**
- Multi-source event detection
- Data from different sources can be combined to give a more accurate report

**Problem Definition**
- **Motivation**
  - Shooting is an important indication of criminal activity
  - Most systems rely on audio detection
  - Use other data sources to detect shooting in real time

- **Replay Scenario for Developing & Evaluating**
  - Use simulated data as real data is difficult to obtain
  - 15 student actors simulate shooting events
  - Walk normally, then start running away from area

- **Approach**: Detect the sudden changes in people distribution in the area. This is a common pattern observed when a shooting occurs.

**System Architecture**
- Janus 3 tiers architecture paired with a real-time **Replay Module**
- Replay Module simulates input raw streams

**Capabilities**
- **Monitoring People Behavior**
  - Break-up area of interest in cells
  - For each cell we detect and compute the number of people *running*
  - Apply aggregation functions in a rolling time window
  - Identify which cell exhibits a significant change in the number of running people within a small period of time

- **Temporal Aggregation**:
  \[ f_{T_{ij}} = \max(\forall x > y, x = [1,3], y = [1,3], \frac{T_{x,y} - T_{y,y}}{t_{x} - t_{y}}) \]

- **Spatial Aggregation**:
  \[ f_{S_{ij}} = \text{Count}(\forall k = [-1,1], A_{T_{i-k,j-k}} > TR) \]

- **Monitor Tweets Distribution**
  - Isolate areas where high volume of tweets related to shooting took place suddenly

- **Event Detection**
  - If both trajectories and Tweets report a shooting event, likelihood of shooting is increased and user is notified

**Related Research**
- Shooting event detection from audio
- Criminal activity analytics from video

**Conclusion and Future Work**
- Combine data sources to report shooting event detection
- Adaptive parameter learning to characterize real-world scenarios