

**Social Media
Activity**

**Physical Event
Activity**

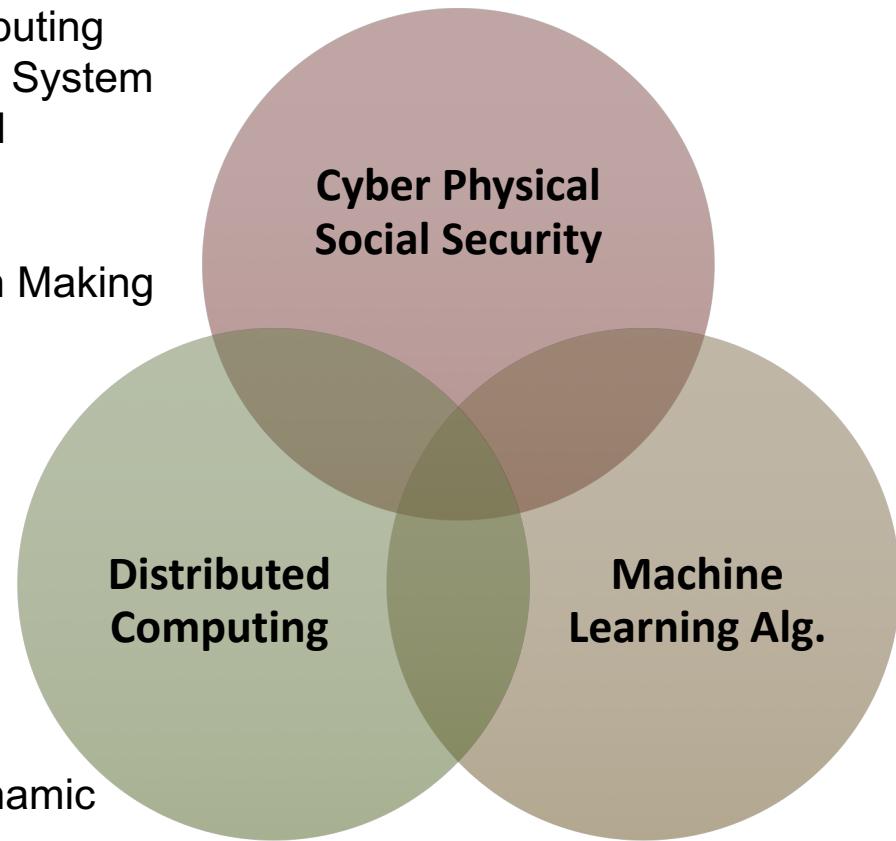
**Cyber Event
Activity**

Paul Rad, Ph.D.

Associate Professor, Cyber Analytics
Department Information Systems and Cyber Security
Co-founder Open Cloud Institute (OCI)
Mobile: 210.872.7259

Cyber Analytics and AI Research

- **Computing:** Secure and Trusted Cloud Computing
 - Real-Time Distributed Machine Learning System
 - High Performance Computing, Edge and Embedded IoT
- **Algorithm:** Autonomous Agents and Decision Making (Human – Agent Teaming)
 - Generative Adversarial Learning
 - Adaptive Learning & Behavior Modeling
 - Explainable Deep Learning
 - Knowledge Graph
- **Application:** Cyber-Physical Security Threat
 - Threat Intelligence
 - Visualization, Threat Evolution, Dynamic Risk Assessment
 - Malware Encrypted
 - Perception



Cloud Computing Research

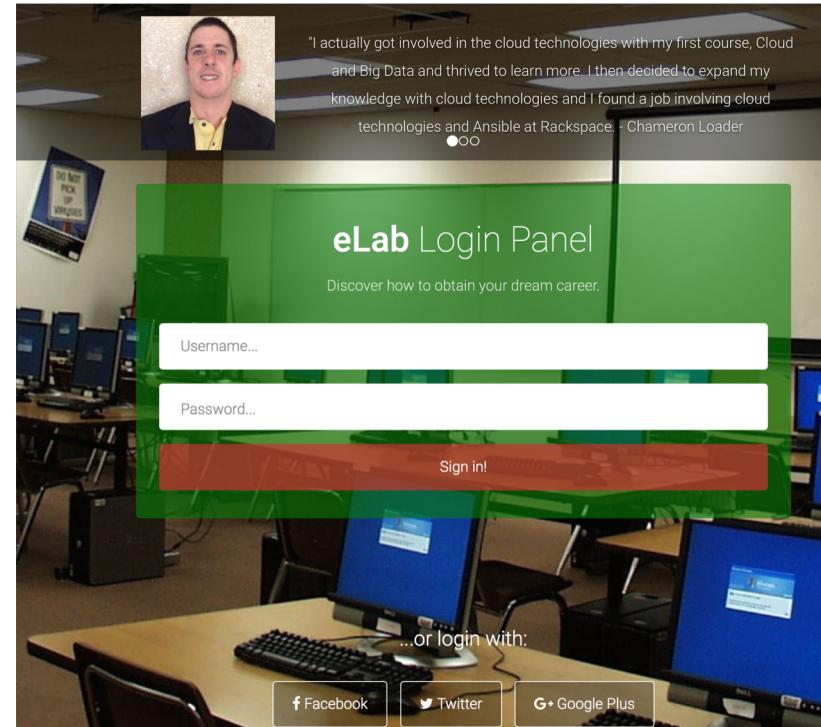
Funded Cloud Computing Research 2014-2019

\$10* M	A configurable experimental environment for large-scale cloud research	NSF
\$6.6* M	Building a high performance cloud for science and engineering research	NSF
\$5* M	Testing, Evaluation, and Control of Heterogeneous Large Scale Systems of Autonomous Vehicles	U.S. Air Force
\$100* K	A Cloud Computing Pipeline for Precision Medicine	SALSI
\$ 230 K	Talent Pipeline OpenStack Developer	Intel
\$ 25 K	Cloud Based Data Analytics and Machine Learning for Bioinformatics	UT Health Sciences
\$ 500K	Cloud data analytics	Rackspace
\$ 400* K	Forensics and Machine Learning Smart Grid	CPS
\$105K	Cyber Physical Hunting	Cisco
\$2 M	Intelligence Community Centers of Academic Excellence Critical Technology Studies Program	DIA

* Collaborative research

Cloud Computing Education

- **Cloud Computing Certification**
 - Cloud Security
 - Cloud Application
 - Cloud CORE Infrastructure
- **Industry Boot-camp Training and Certification**
 - “Intel OCI Internship” Cloud Computing Core OpenStack Infrastructure Programming.
- **Cloud Education Lab**
www.cloudelab.org
 - Working to build the best cyber and cloud technology education, innovation and workforce available anywhere.

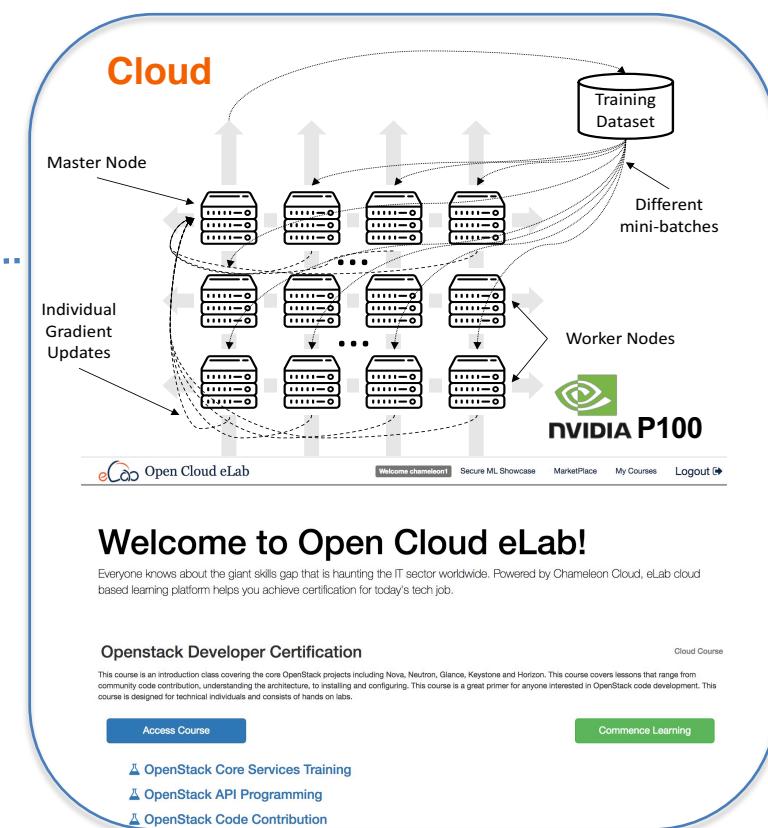
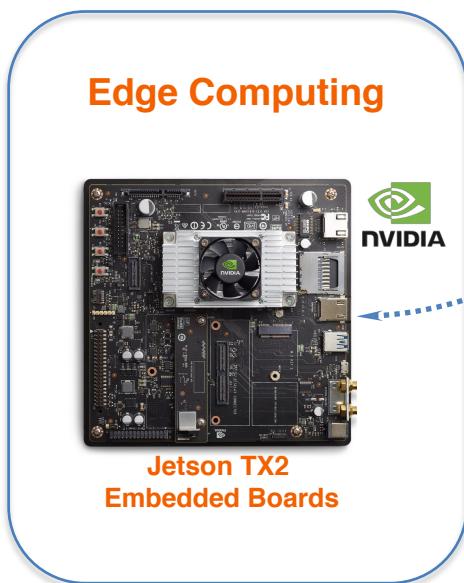


Machine Learning Pipelines

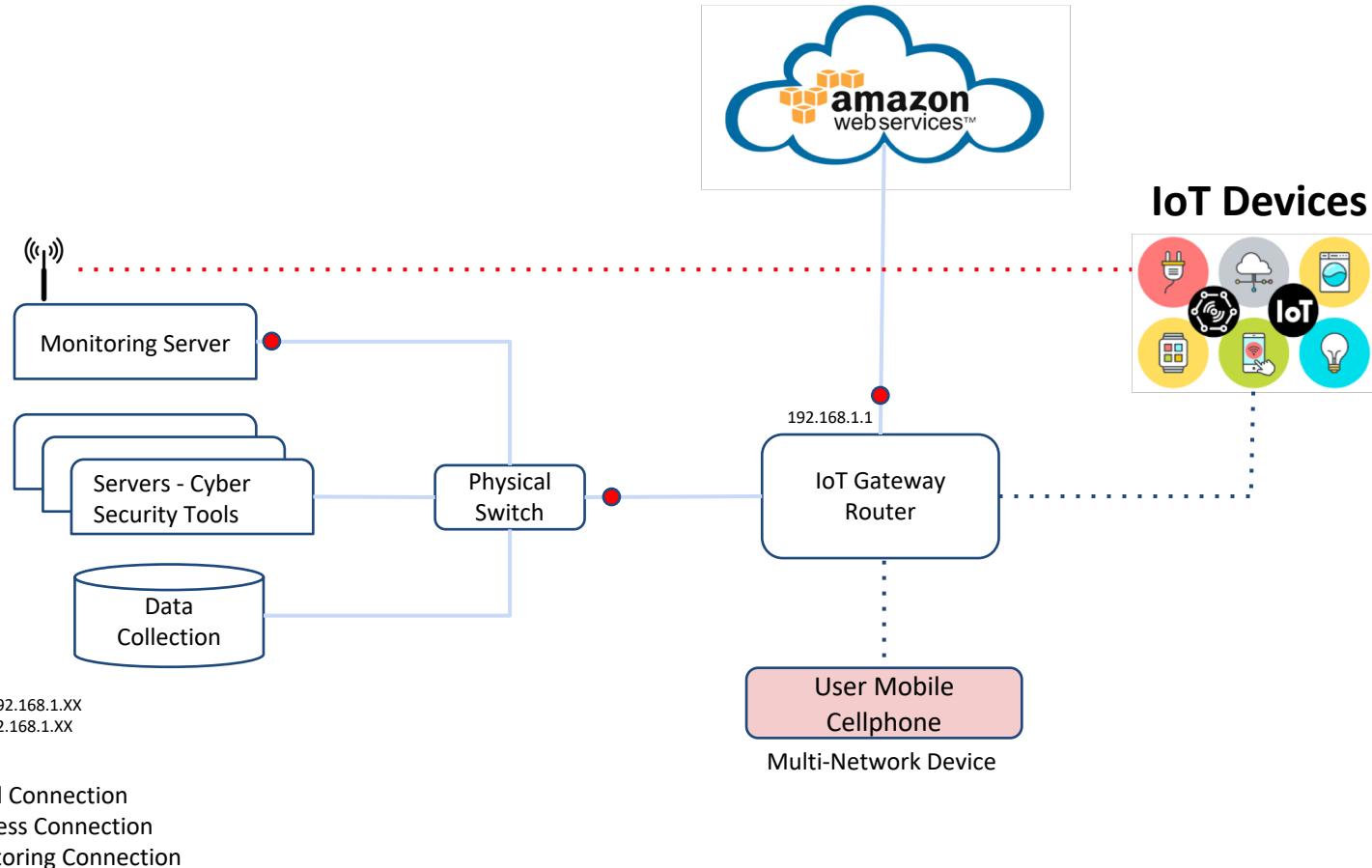
Research Objective

We propose distributed deep neural networks over distributed computing hierarchies, consisting of the cloud, the edge and end devices.

Methodology:

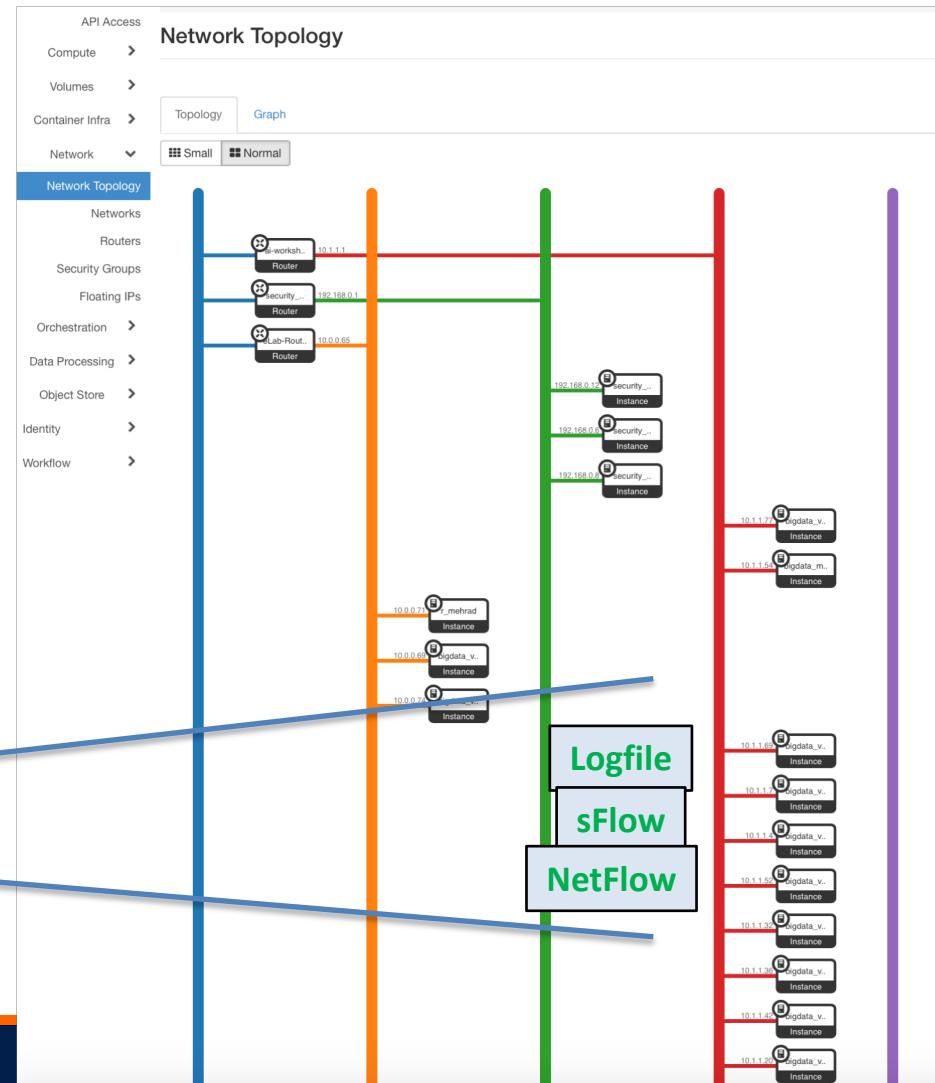
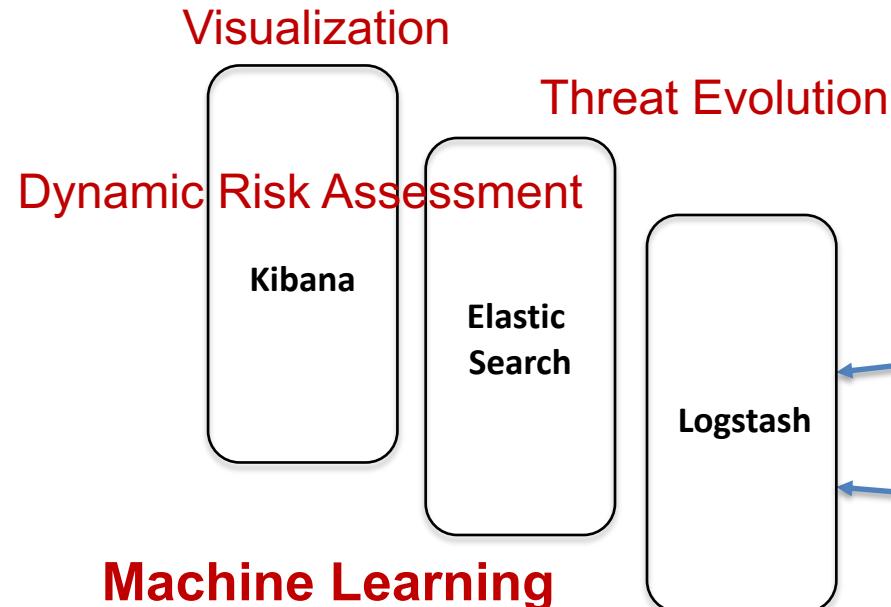


Cybersecurity Testbed for IoT and Machine Learning Experimentation



Cloud Cybersecurity Testbed Experimentation (Threat Intelligence)

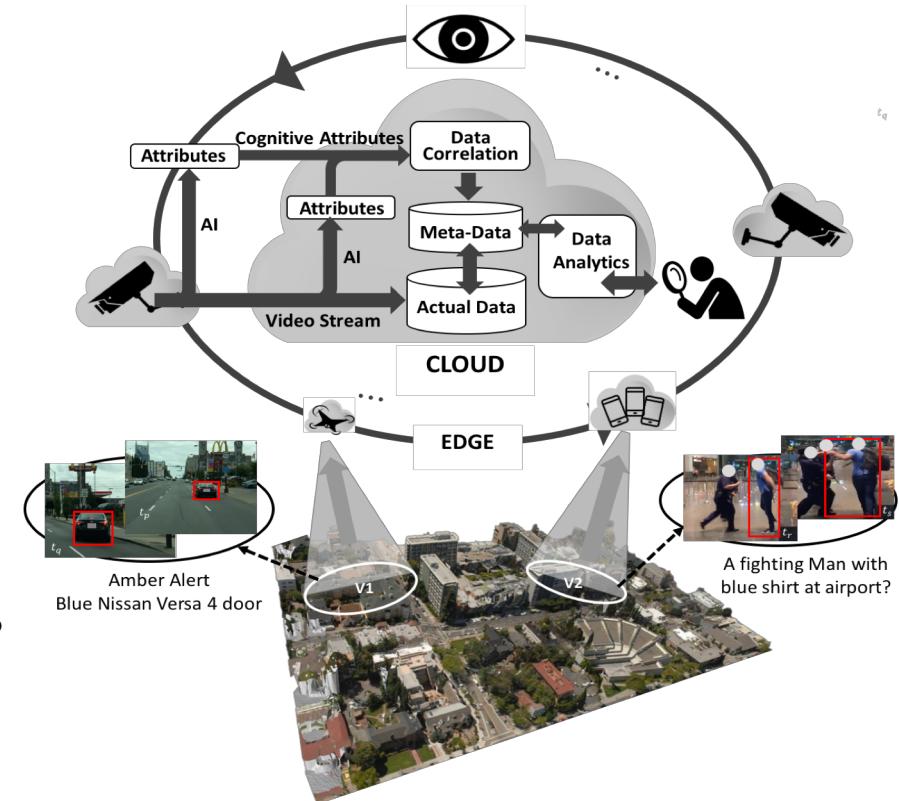
The process of proactively and iteratively searching through logs and networks to extract knowledge or insights from data in various forms to detect and isolate advanced threats that evade existing security solutions



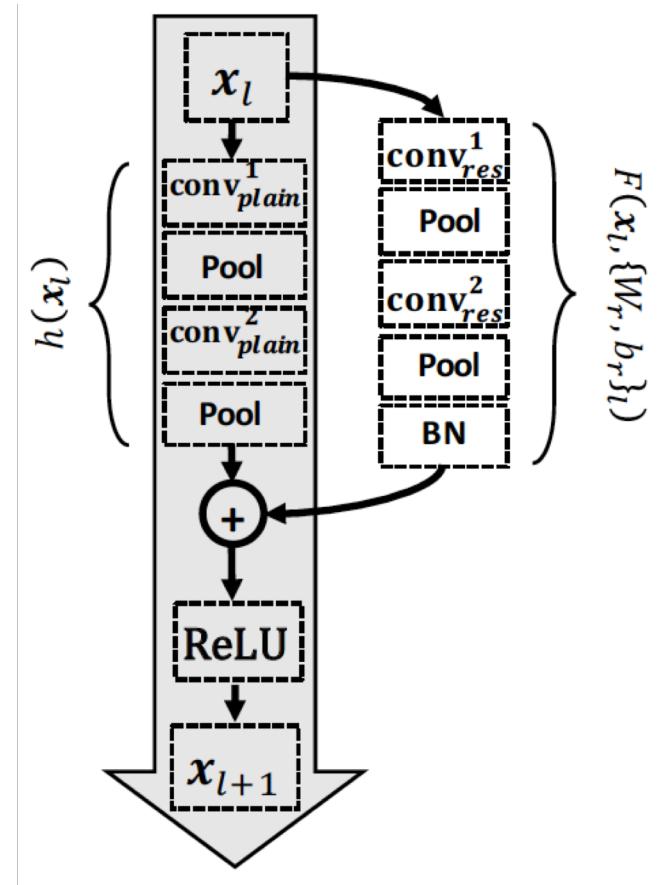
Cyber–Physical Hunting at Smart Cities Using Edge–to–Cloud Analytics

We propose EYES, a novel method of cyber–physical hunting to reduce the real–time semantic gap in automatic video interpretation and retrieval for not only simple images and features, but also rich and meaningful higher level interpretations of situations and events in images/videos stream captured from smart cities.

We will leverage previous developments in distributed cloud analytics that allow us to efficiently store and retrieve large quantities of video footage along with novel machine learning methods capable of interpreting those videos in a meaningful way

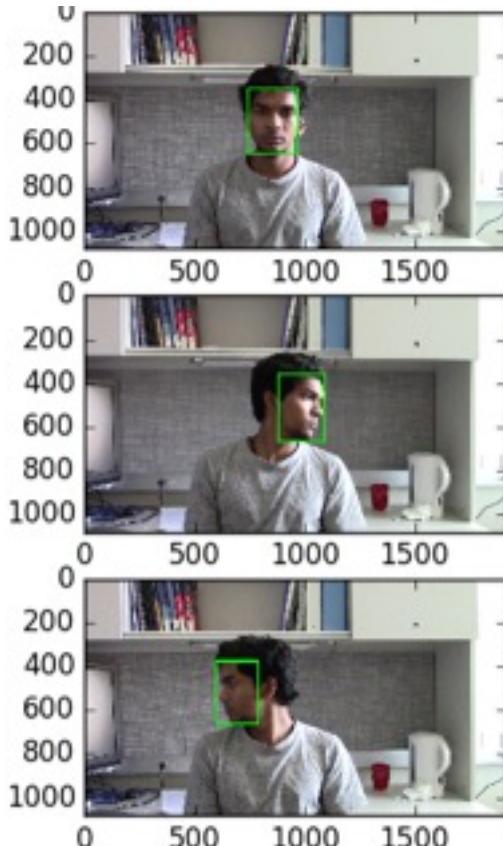


Crowd Facial Analytics

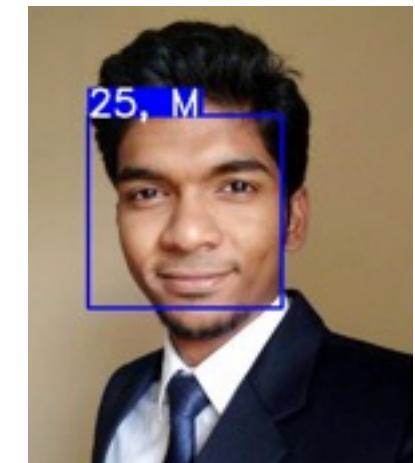


Face Re-identification, Emotion, Pose, Age, Gender

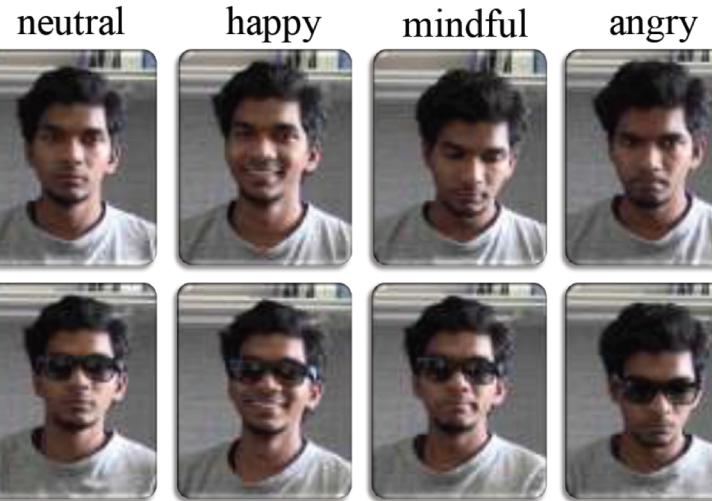
Face Recognition
Different Pose



Face-Age-Gender



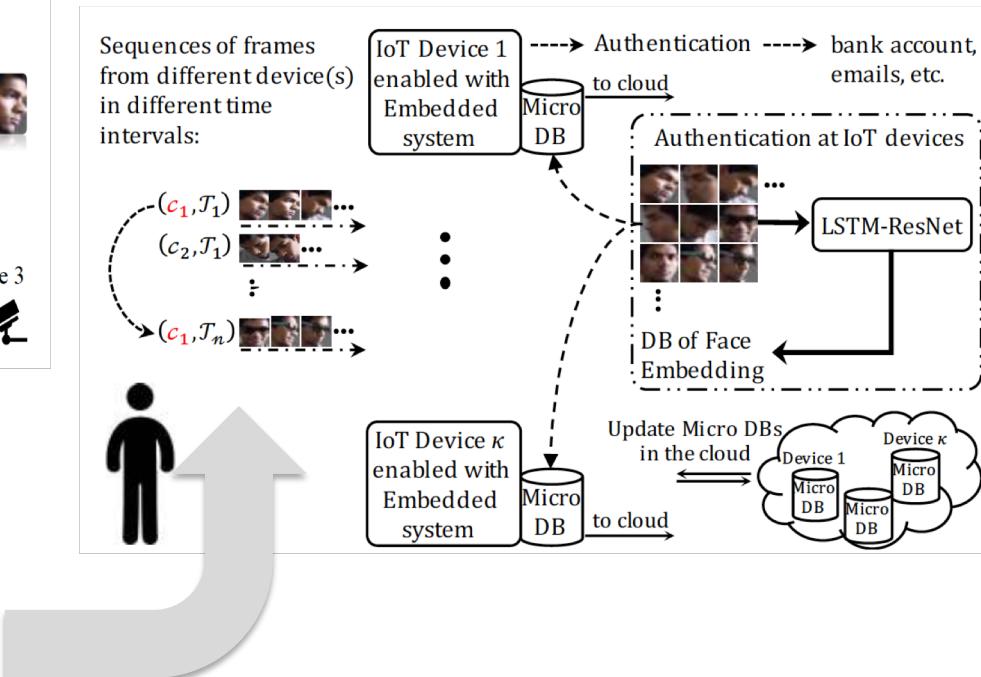
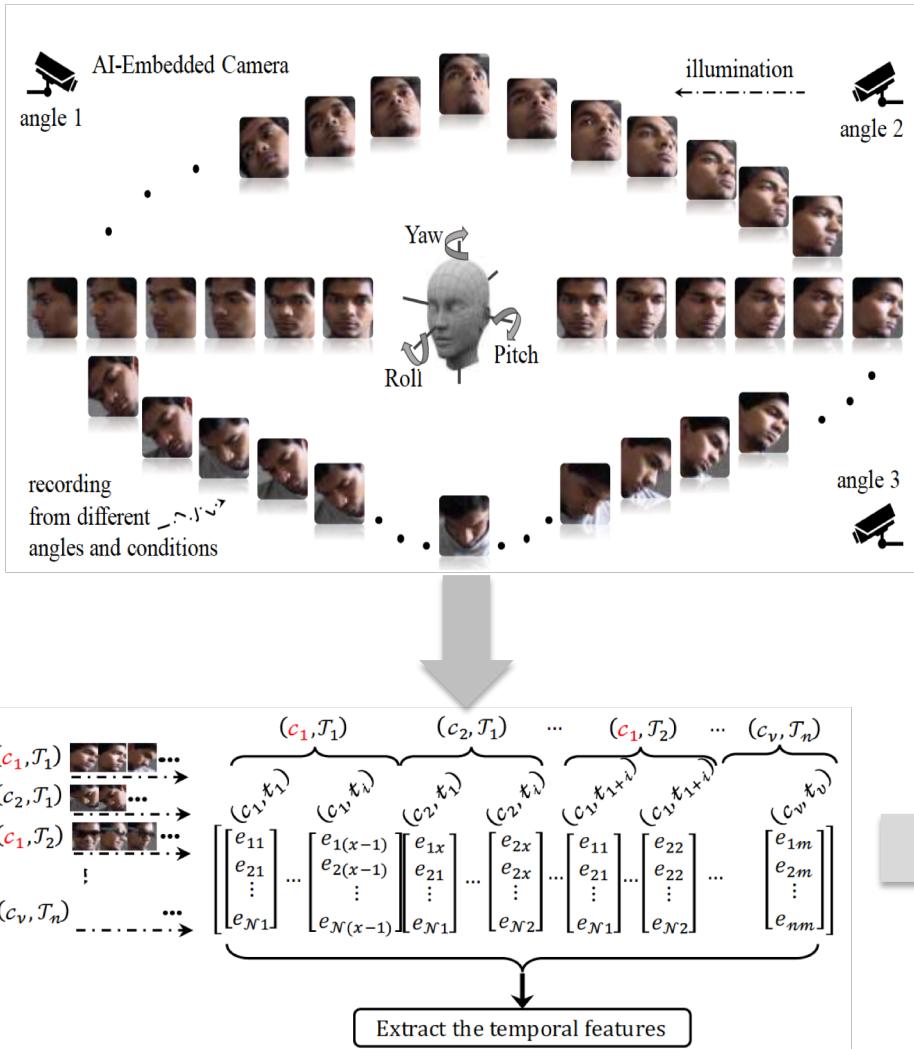
Face-Emotion Detection



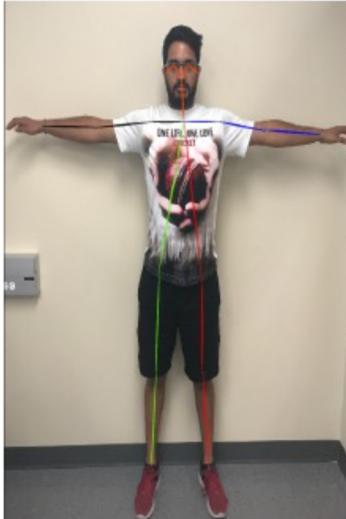
Face Recognition-Different scale



Decentralized ID: Blockchain + Embedding Biometrics



Quantitative Action Detection



Limbs	Color Code	Tensor	Relevance
Head and Face	Orange	$hf = \{hf_1, hf_2, hf_3, hf_4, hf_5, hf_6\}$	Attention
Right Hand	Black	$rh = \{rh_1, rh_2, rh_3\}$	Action (Punching, Shooting, Catching.)
Left Hand	Blue	$lh = \{lh_1, lh_2, lh_3\}$	
Right Body	Green	$rb = \{rb_1, rb_2, rb_3\}$	Action (Kicking, Running, Hitting the ball.)
Left Body	Red	$lb = \{lb_1, lb_2, lb_3\}$	

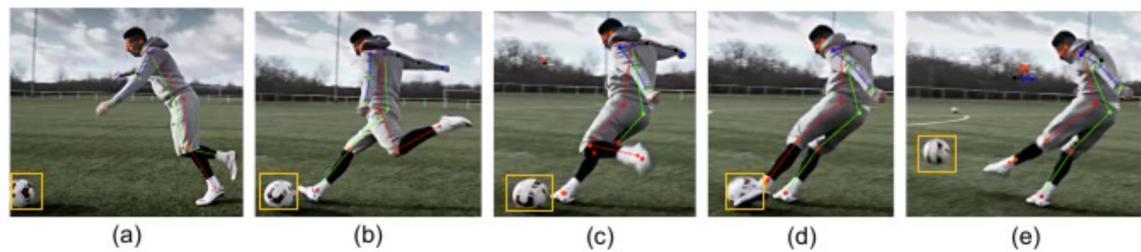
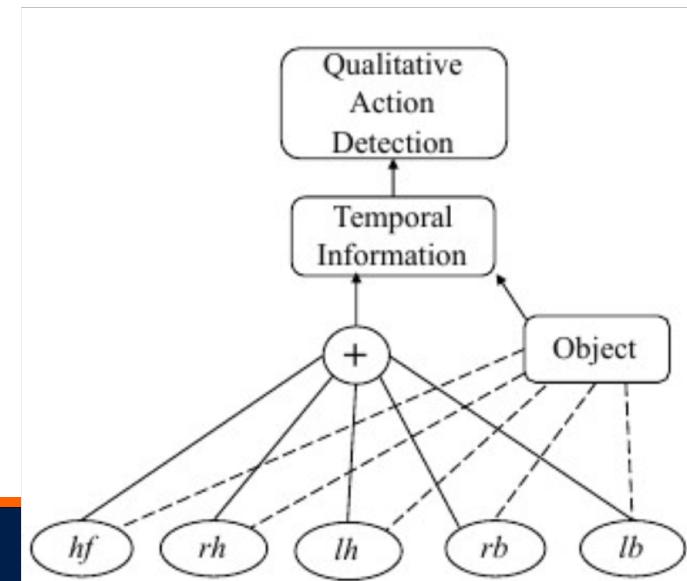
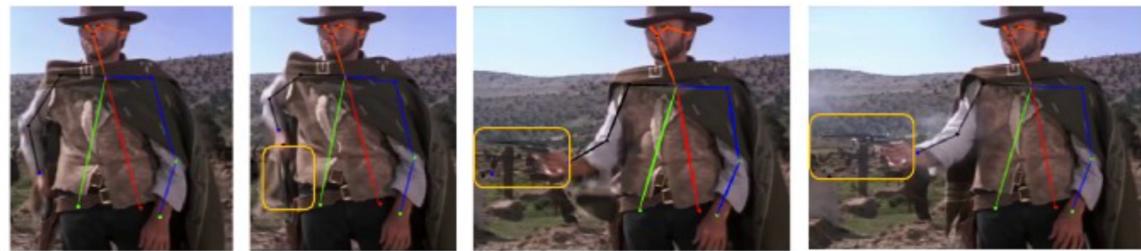


Fig. 8: Frames with different time interval showing the temporal action

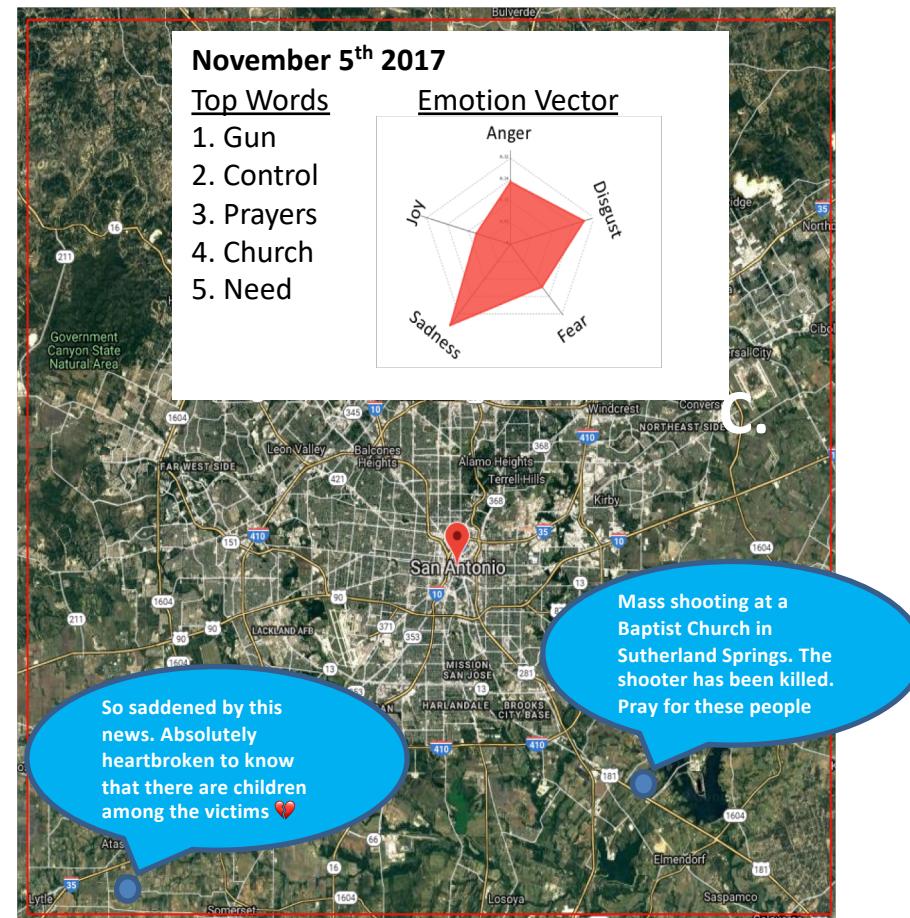


Attention Detection



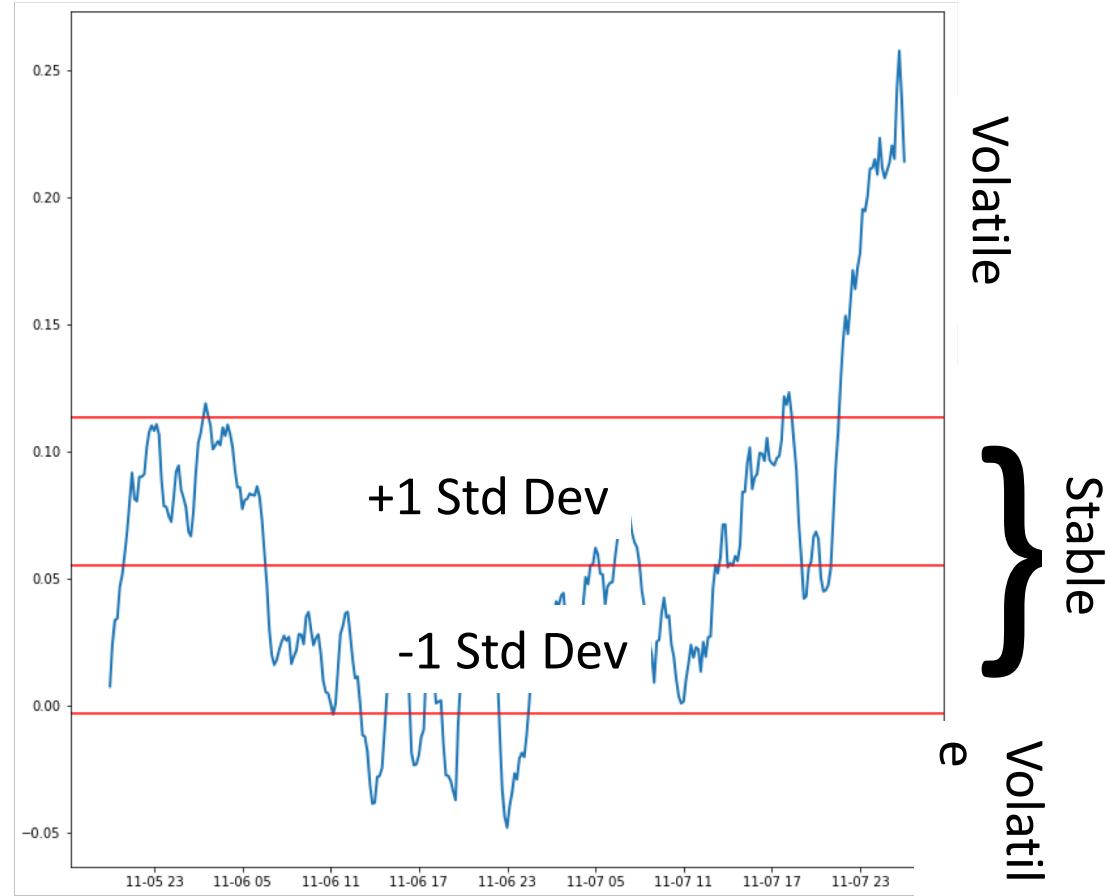
Crowd Event Detection

1. Social media post are collected from a geospatial bounding box
2. The normal emotion of the geospace is measured
3. When the emotional state of a space becomes extreme, topics are extracted
4. Topics are group together to define the event that occurred

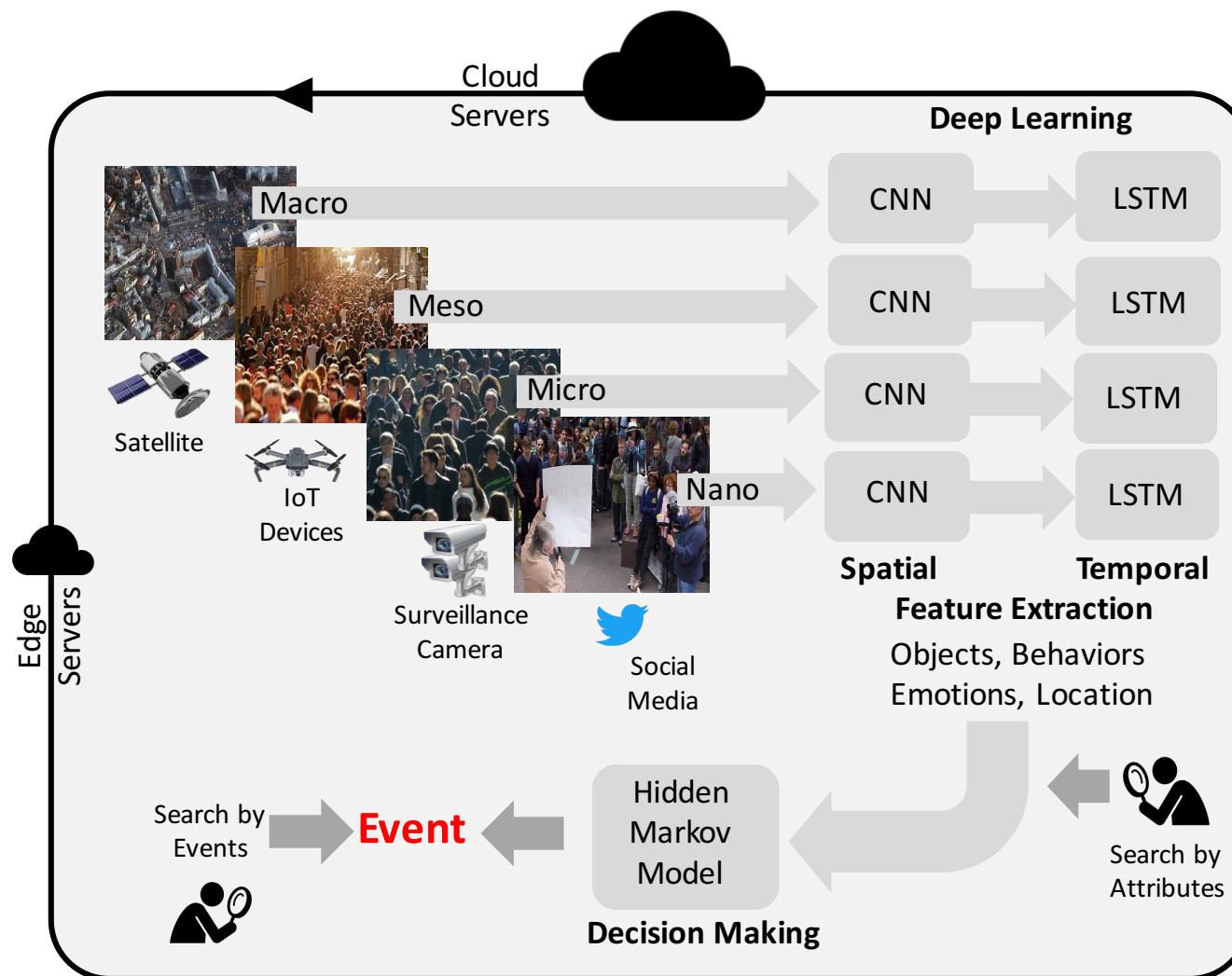


Emotional Stability

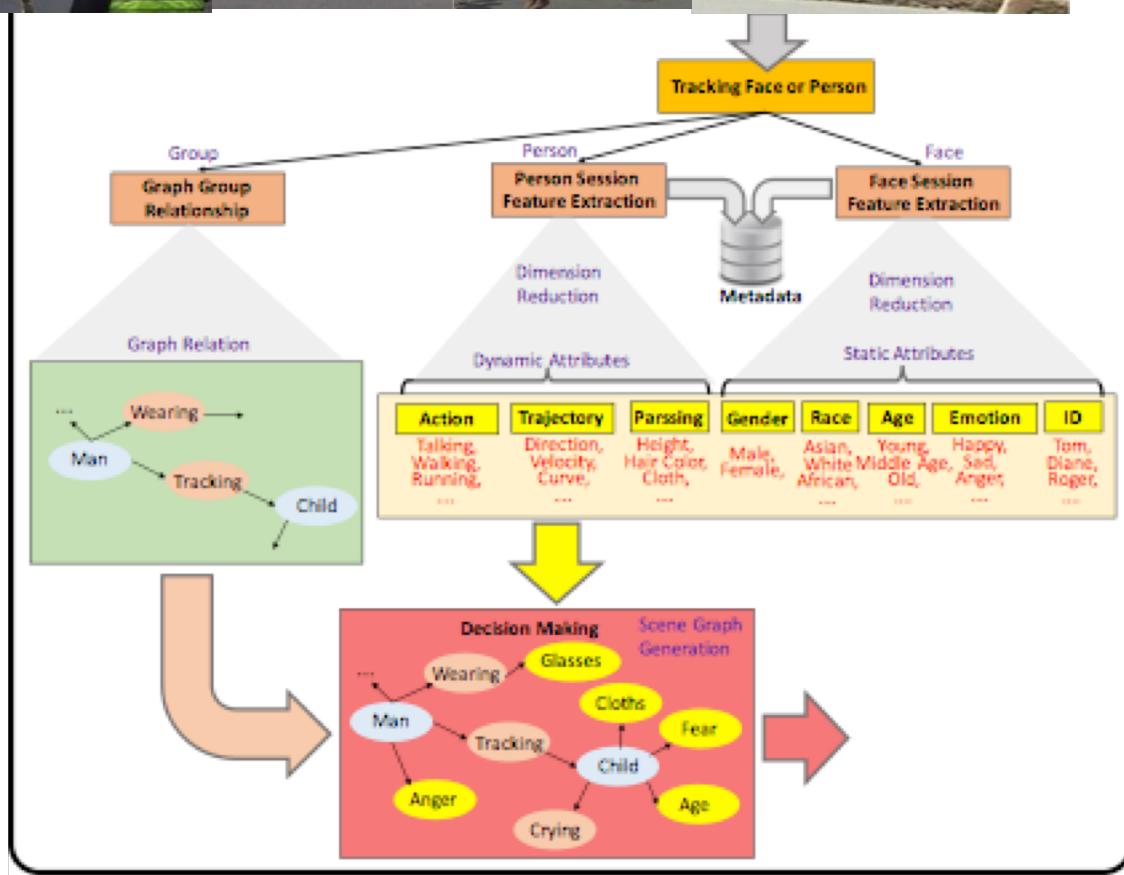
1. The emotion of a geospace is continuously measured
2. The average and standard deviation is continuously measured and graph
3. When the emotion leaves the current measured standard deviation, it begins to apply topic modelling



Cyber-Physical Threat Hunting at Scale

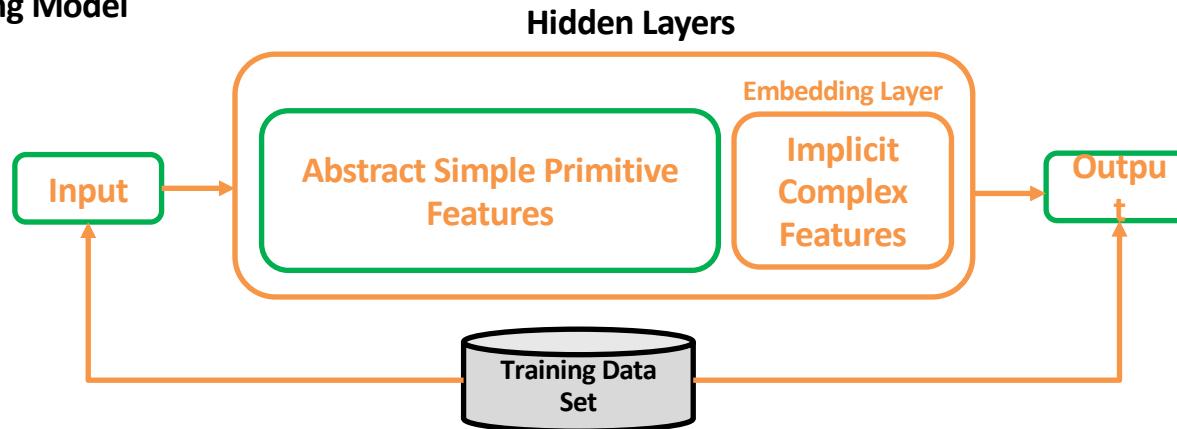


Urban Biometrics



Human – Machine XAI – Hybrid model

Deep Learning Model



Explainable
Deep Learning Model

