Applications of Advanced Information Technologies for Disaster Risk Reduction

THOMAS V. ROBERTSON
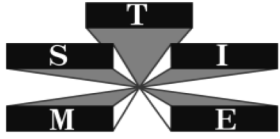
TIEMS NORTH AMERICA DIRECTOR

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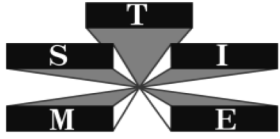
Presentation Objective

Review three technologies that have been recently applied to Disaster Risk Management – how they work, how they are being used, and what good they do:
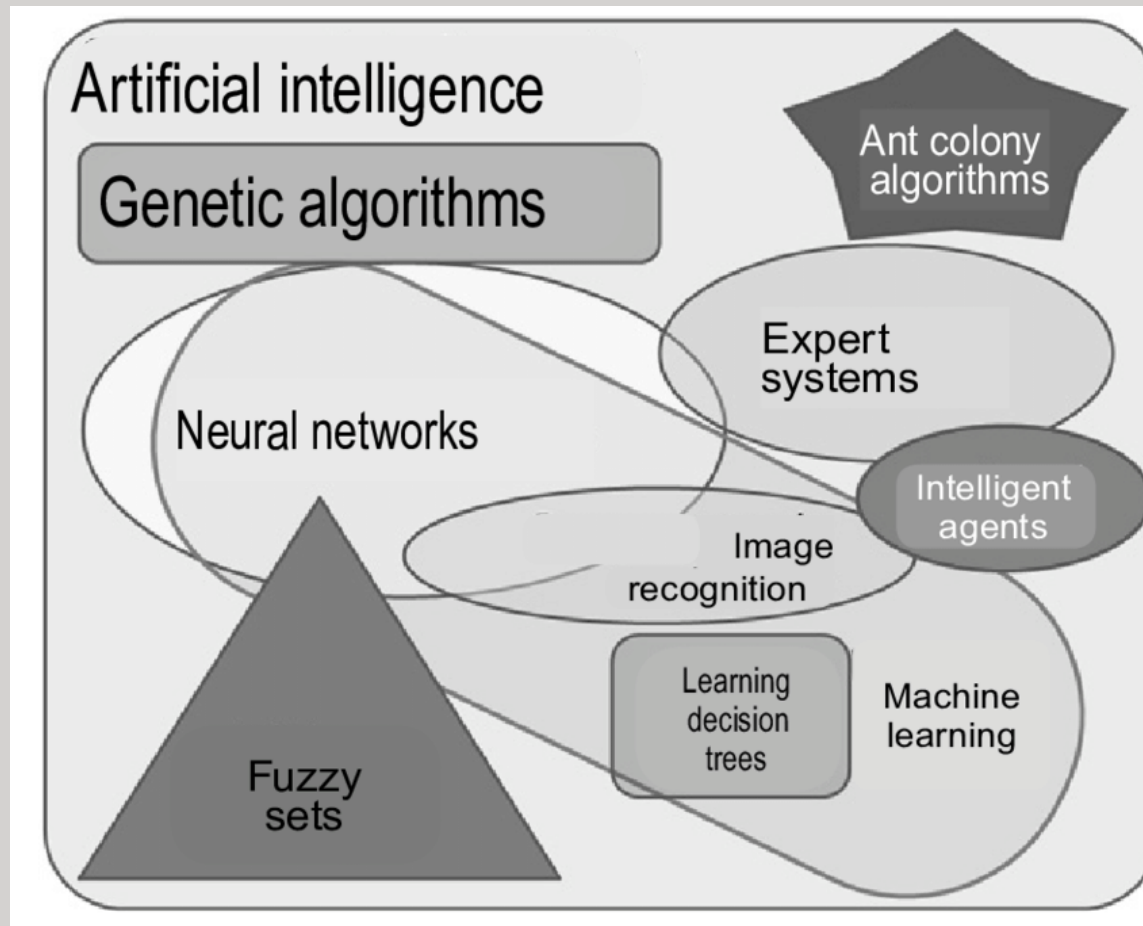
- Artificial Intelligence
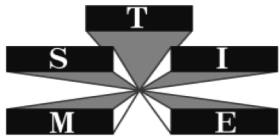- Internet of Things (IoT)
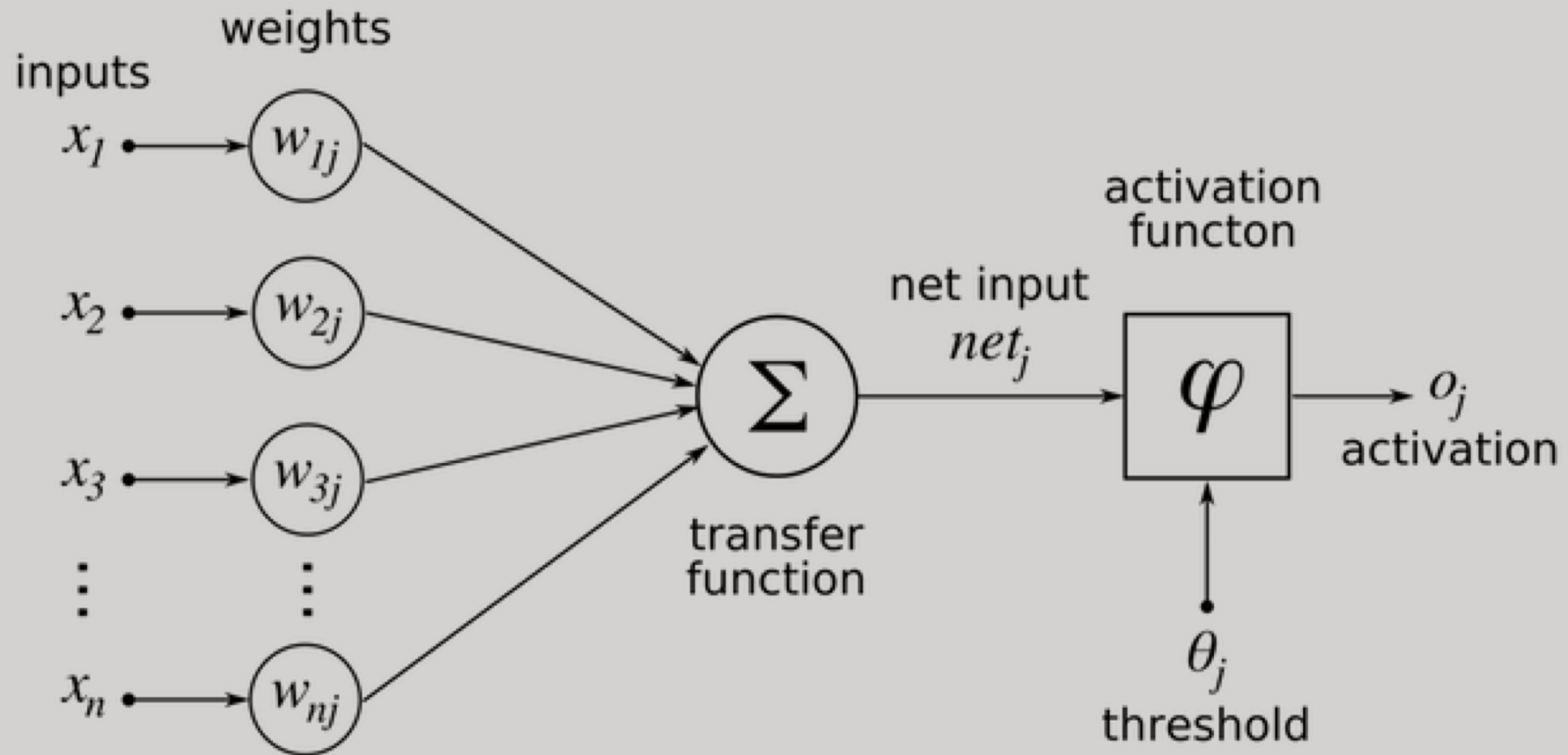- Blockchain

Artificial Intelligence Technologies*

*Lula, Paweł & Morajda, Janusz & Paliwoda-Pękosz, Grażyna & Stal, Janusz & Tadeusiewicz, Ryszard & Wilusz, Wojciech. (2014). Computer Methods of Data Analysis and Processing.
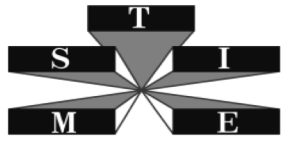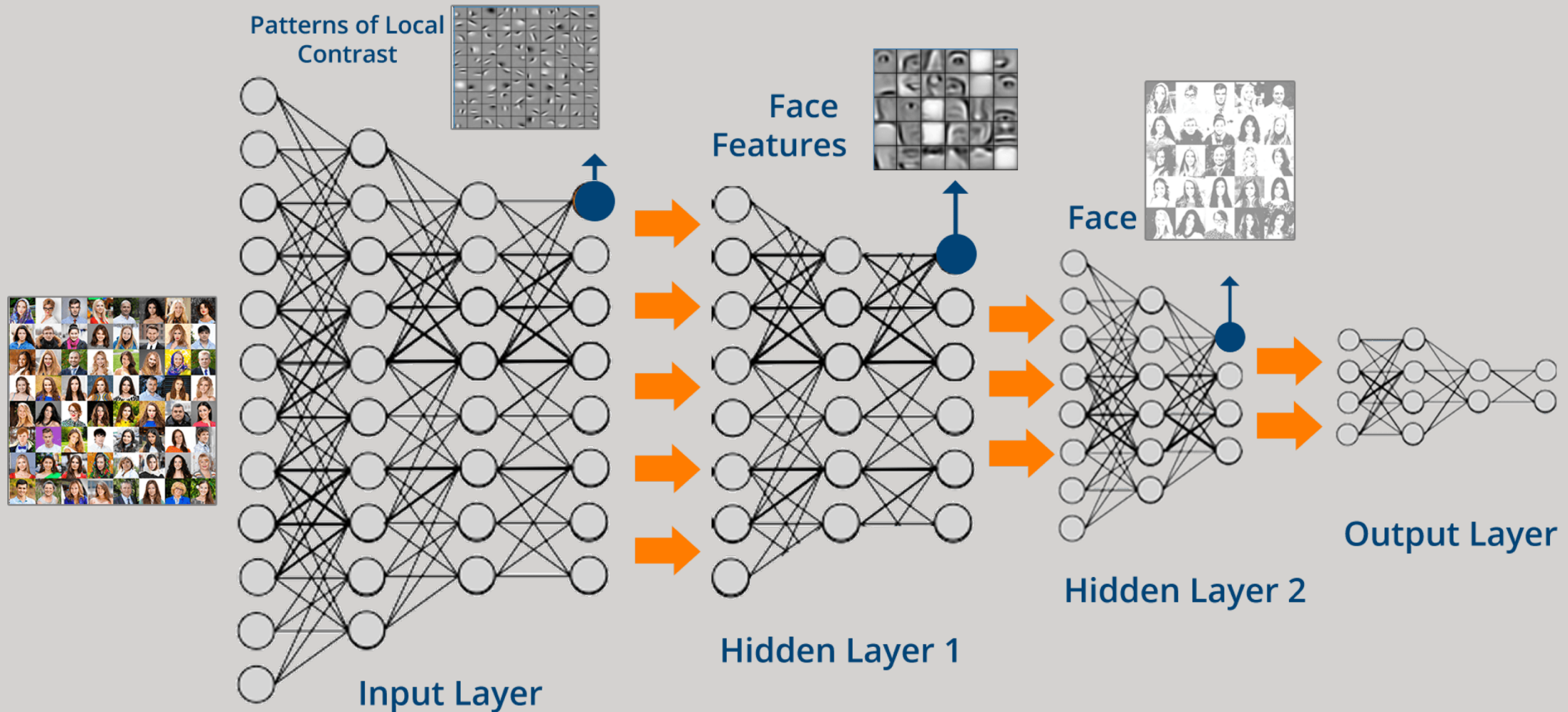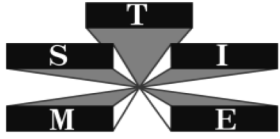
Simple Neural Network

Deep Learning

Patterns of Local Contrast

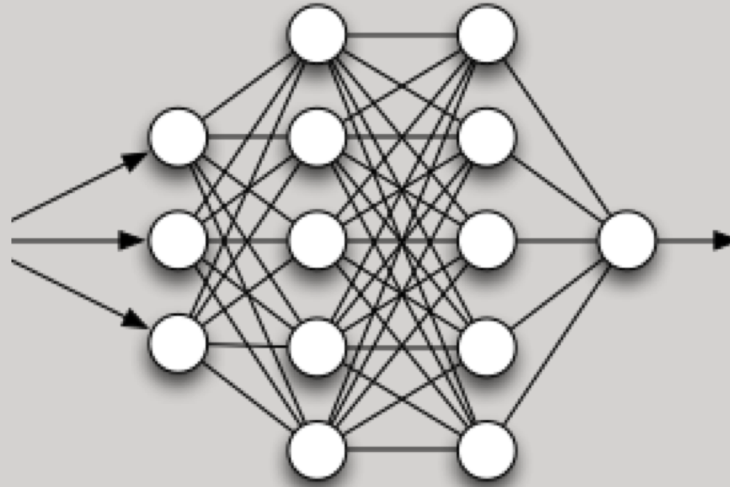Face Features

Face

Input Layer

Hidden Layer 1
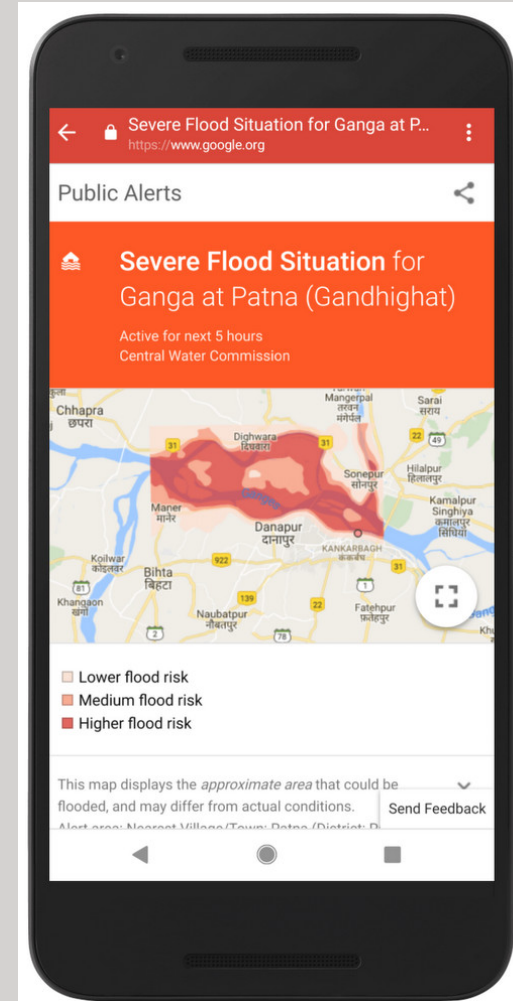
Hidden Layer 2

Output Layer

AI to Predict Floods in India*

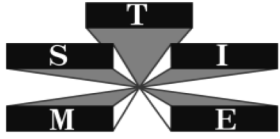*"20 percent of global flood fatalities occur in India*

- Historical events
- River level readings
- Terrain data

Machine Learning

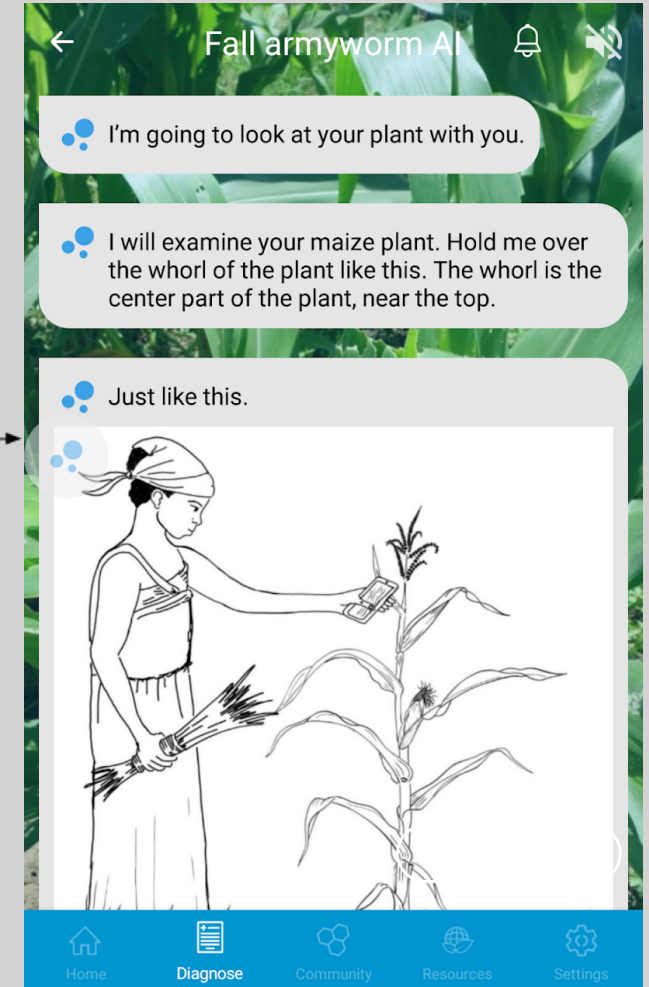*Joint project Google and Central Water Commission of India

Fighting Fall Armyworm in Africa*

- Take picture of crop with cell phone
- Upload data
- Calculates infestation levels
- Management guidance to farmers
- Build up central knowledge base

"Fall Armyworm threatens the food security of over 300 million people in Africa."
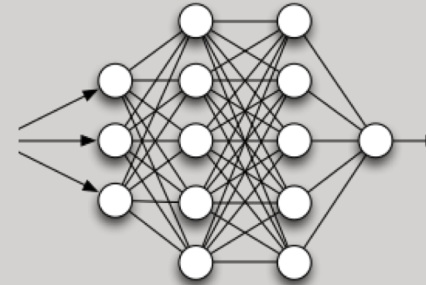
* UN Food and Agriculture Organization and Penn State U.

Thinking Teams
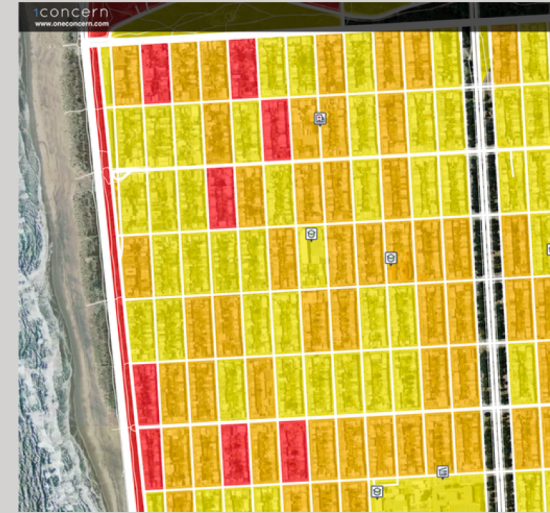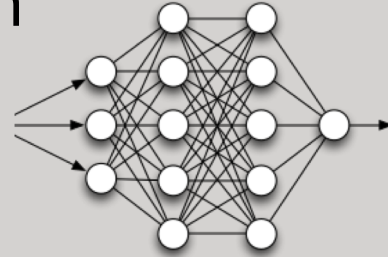
Earthquake Impact Prediction*

- Building age, type, construction
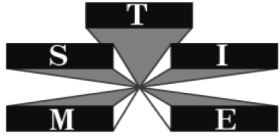- Damage examples
- Seismic data

Map of damage and number of people affected

* One Concern, Inc.

Internet of Things

Embedded Processors

Wireless Comms

Cloud Computing

INTERNET of THINGS

SMART CITY

IoT-Based Rio Operations Center

Problem: *poor response to catastrophic flooding and landslides*

Impact:
- *50 agencies cooperating*
- *More effective disaster response*
- *Smoother traffic flow*

- Rain gauges
- Radar sensors
- Bus GPS
- Images
- Social networks

RIO Operations Center

- Decision support
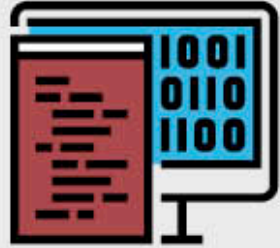- Social media posts
- News outlets
- Sirens
- Traffic flow
- Wait times

What is Blockchain?

A digital ledger that keeps a record of all transactions taking place on a peer-to-peer network

All information transferred via blockchain is encrypted and every occurrence recorded, meaning it cannot be altered

It is decentralised, so there's no need for any central, certifying authority
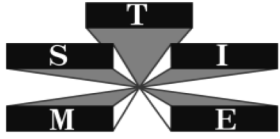
It can be used for much more than the transfer of currency; contracts, records and other kinds of data can be shared

Encrypted information can be shared across multiple providers without risk of a privacy breach
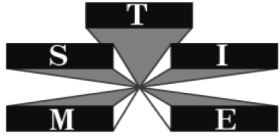
Source: *IoT World News*

Why Blockchain?

- Blockchain is a distributed and immutable digital leger, secured by cryptography, which can be programmed to record a series of transactions

- Facilitates interoperability and transparency

- CDC – blockchain trial to enable a shared, decentralized, and real-time record of truth

- UNICEF – testing blockchain to track status of international grants in a way that is accessible to the public and insures transparency

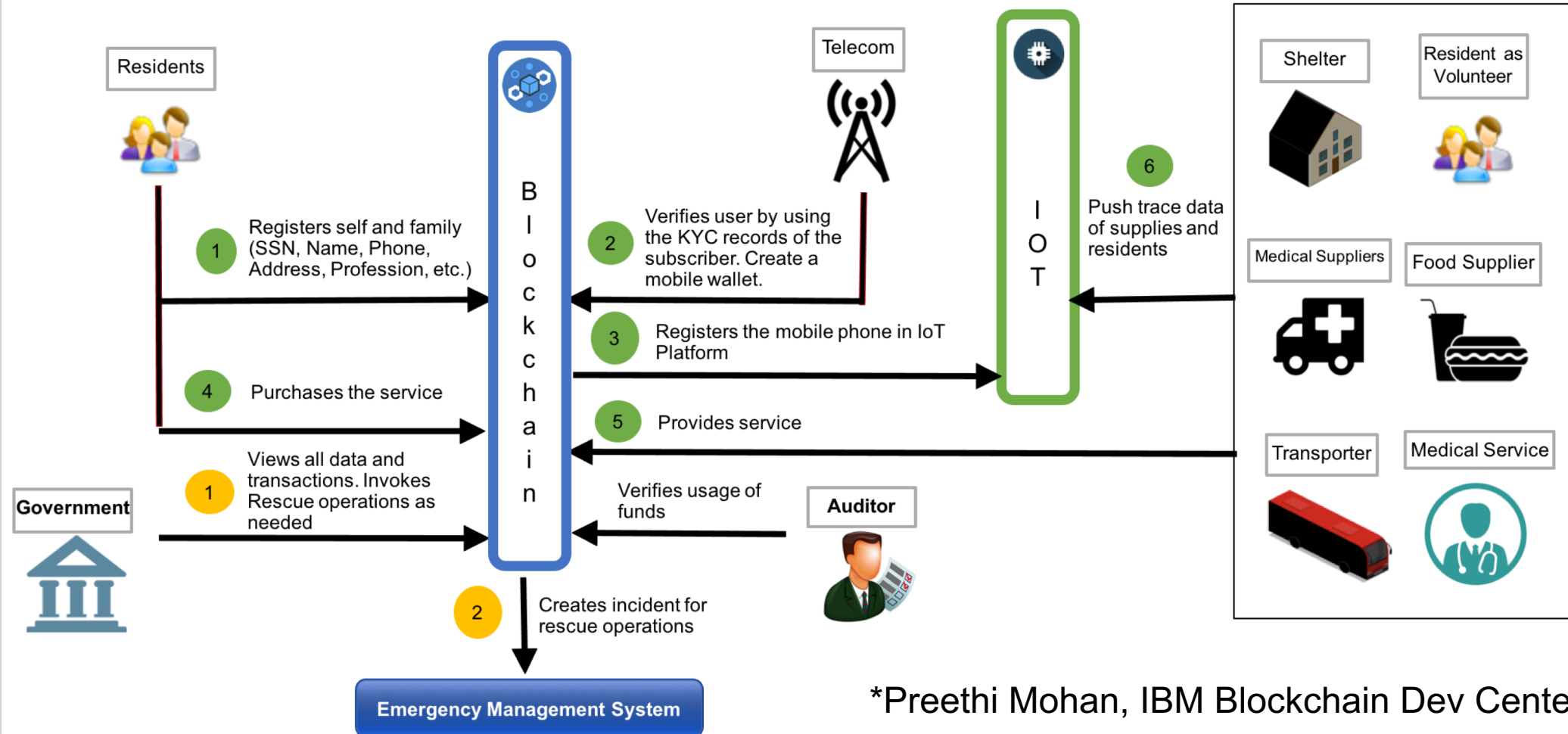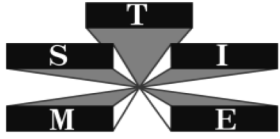- Auditing and oversight enforced in real-time, rather than after-the-fact

Blockchain in Emergency Management*

*Preethi Mohan, IBM Blockchain Dev Center

Summary

- Recent development in Deep Learning have opened up new applications of applying large volumes of experiential data to prediction and decision making

- A confluence of small, powerful embedded processors, ubiquitous wireless communications, and cloud computing allows disaster response based on more accurate and timely information

- The "administrative" aspects of disaster response can make or break effectiveness – blockchain can help