UNITED NATIONS
ESCAP
Economic and Social Commission for Asia and the Pacific

Big Data innovations for disaster resilience

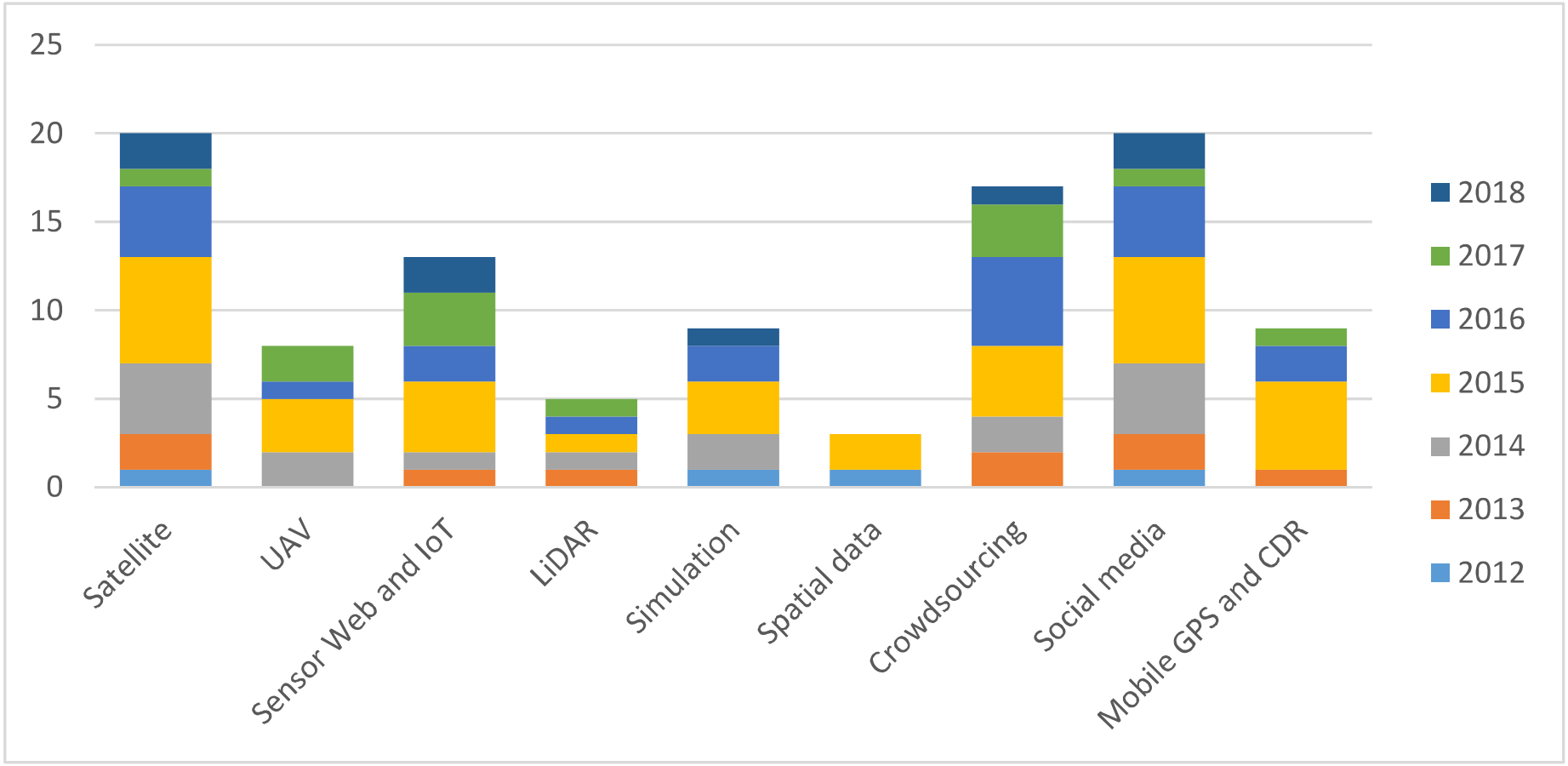


WebEx Seminar

27 March 2019

Big Data in DRR

Increasing use of Satellite imagery, crowdsourcing, and social media



Source: **Manzhu Yu et al** reviewed articles by major data sources (2012-2018)

#1 Case study:

Super typhoon Typhoon Mangkhut

Source: WANG Jianjie

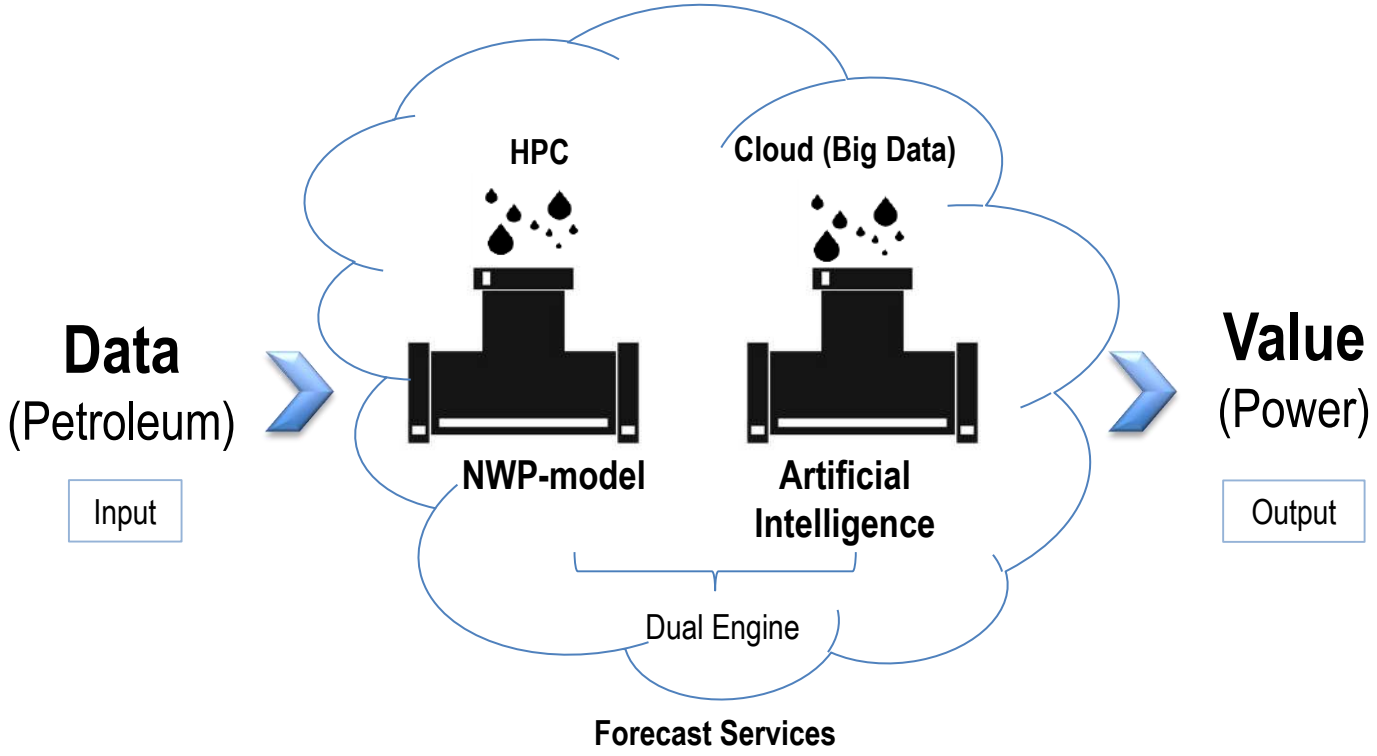
Director-General of NMC/CMA

ESCAP/WMO Typhoon Committee, 51st session

26 Feb. – 1 Mar. 2019

Guangzhou, China

Gridded, Smart and Impact Based and Risk Informed Early Warning

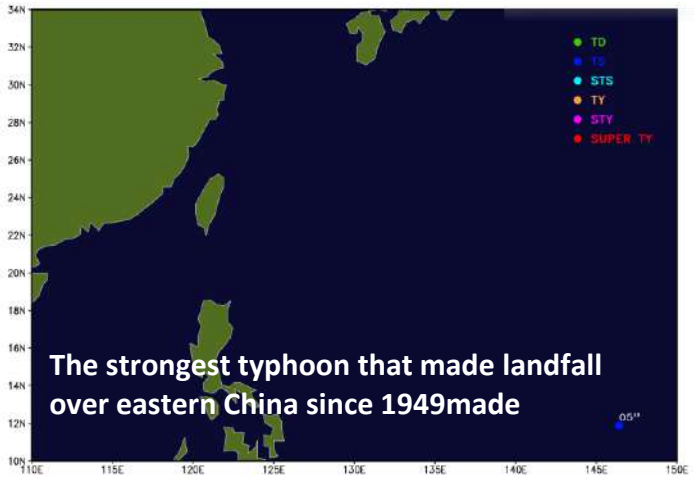


Source: CMA (2017)

Dual Engines for Meteorological Services:

Numerical Weather Prediction model + **AI** (Big Data Application)

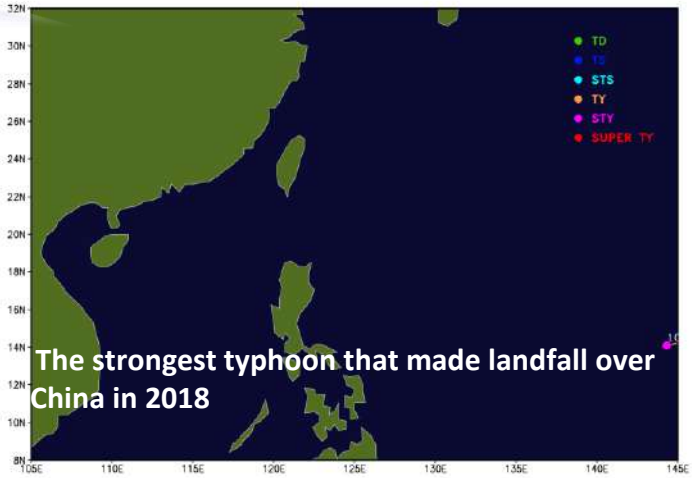
SAOMEI (2006)



SAOMEI made landfall over Zhejiang Province on 10 August 2006, with maximum winds up to 60m/s and minimum pressure 920 hPa.

SAOMEI killed **483 people**, 1.8 million people were evacuated, the total direct economic loss is around **19.65 billion** RMB.

MANGKHUT (2018)



MANGKHUT made landfall over Guangdong Province on 16 September 2018, with maximum winds 45m/s and minimum pressure 955 hPa.

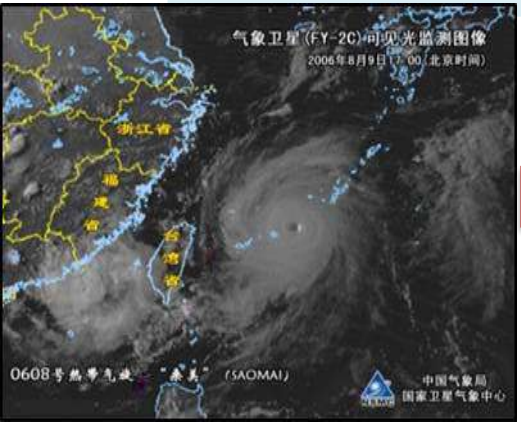
Only **6** people were dead due to MANGKHUT, 1.5 million people were evacuated, the total direct economic loss is around **14.23 billion** RMB.

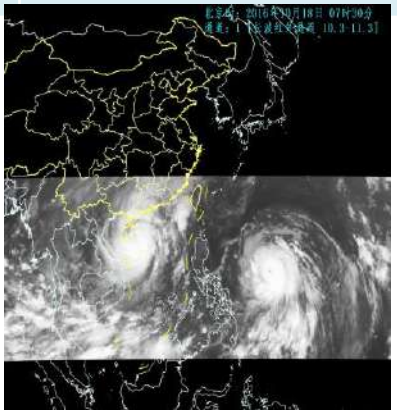
Source: WANG Jianjie, CMA 2019

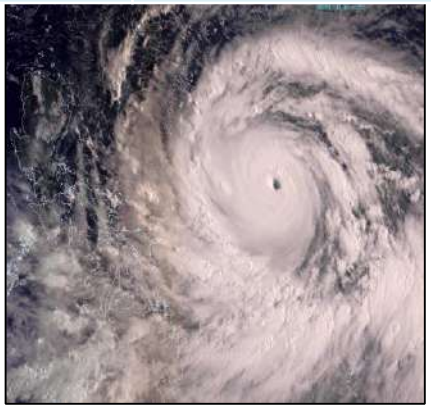
Improvements on Observations - Satellites

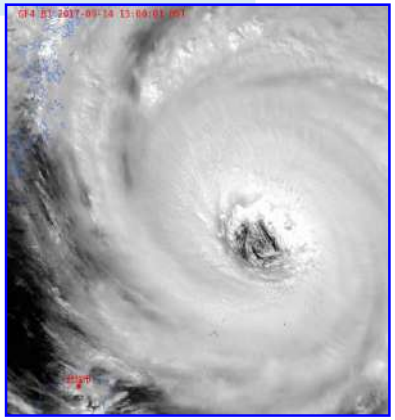
2006 → 2018

	2006	2018
Satellites on-orbit Geostationary Polar Orbit	3 FY1D FY2C\D	8 FY4A\2E\2F\2G\2H FY3A\3B\3C\3D
Time Resolution	30 min (FY-2)	5 min (FY-4A)
Horizontal Resolution	1.25km (FY-2)	500 m (FY-4A)
Channel Num.	5 Channel (FY-2) 3 Channel (FY-1A/B)	14 Channel (FY-4) 10 Channel (FY-3A/B)
Instrument Payloads	2(FY-1A/B) 1(FY-2A/B/C/D/E)	10 (FY-3D) 3 (FY_4A)): AGRI, GIIRS, LMI



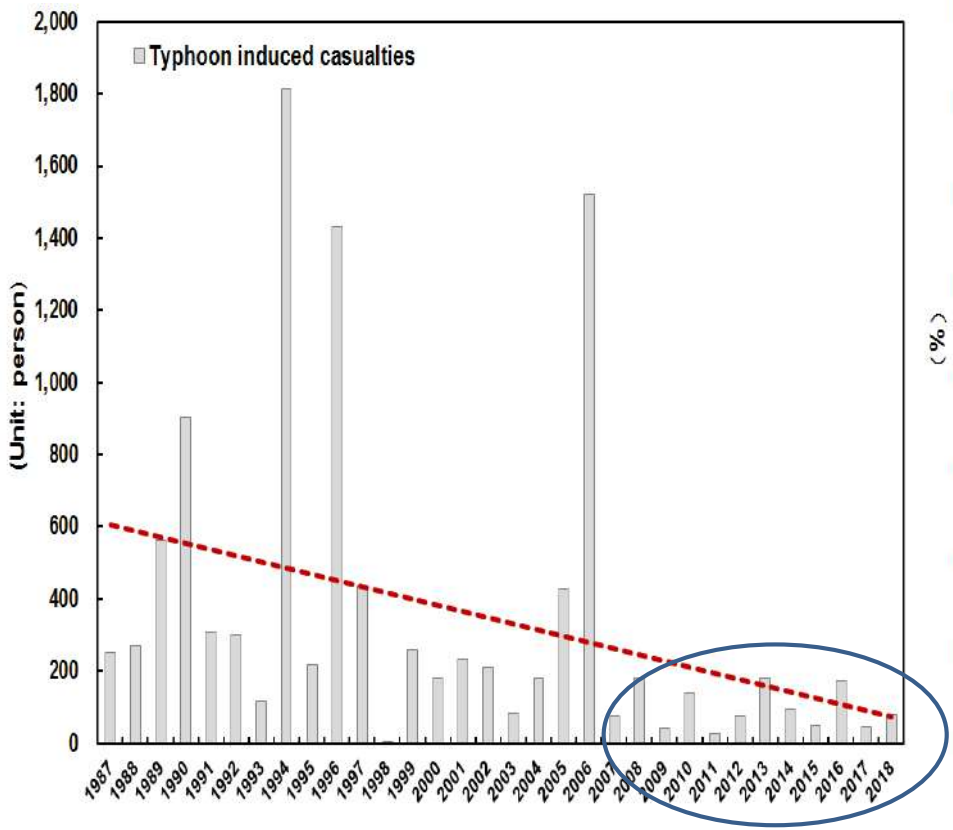


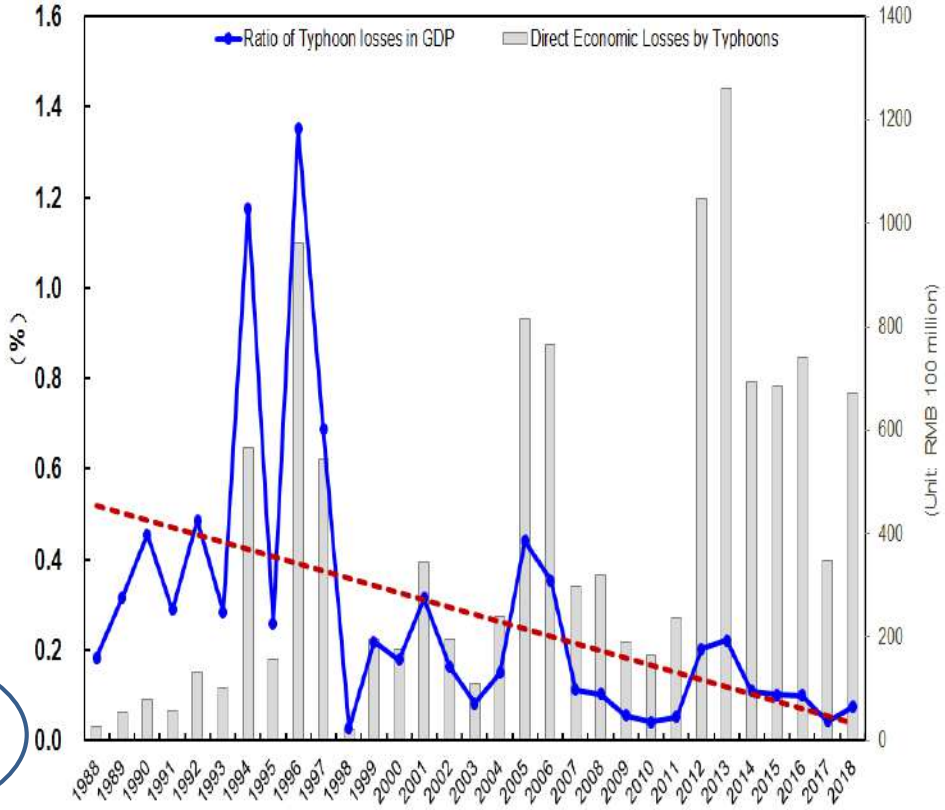




Source: WANG Jianjie, CMA 2019

China: Typhoon Induced Casualties and Economic Losses in past 30 years





Due to the improvement of typhoon forecasts and warnings, and more effective emergency responses for typhoon events, **the casualties and the ratio of typhoon-induced losses to GDP reduce remarkably**

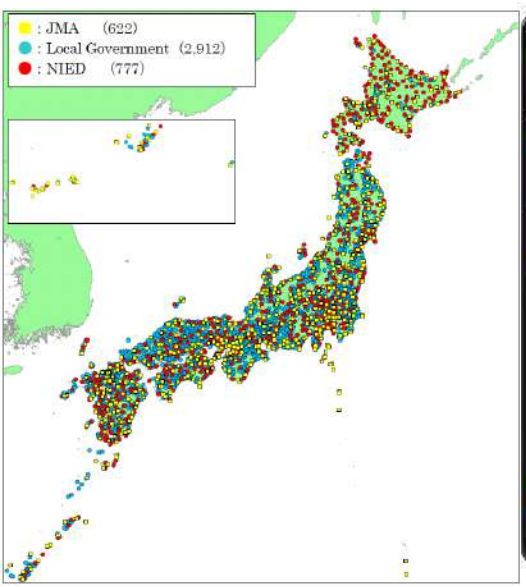
Source: WANG Jianjie, CMA 2019

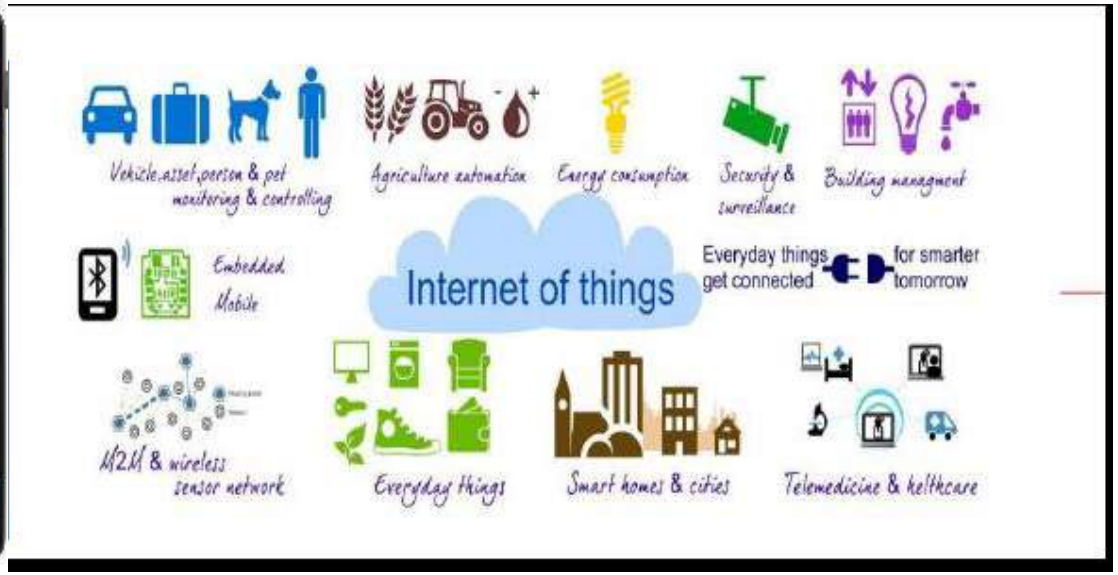
#2 Case study:

IoT standalone sensors are augmented by Zizmos smartphone apps
(Zizmos eQuake)

Source: Robert Armitano,
Entrepreneur (2017)

IoT enables efficient earthquake early warning in Japan



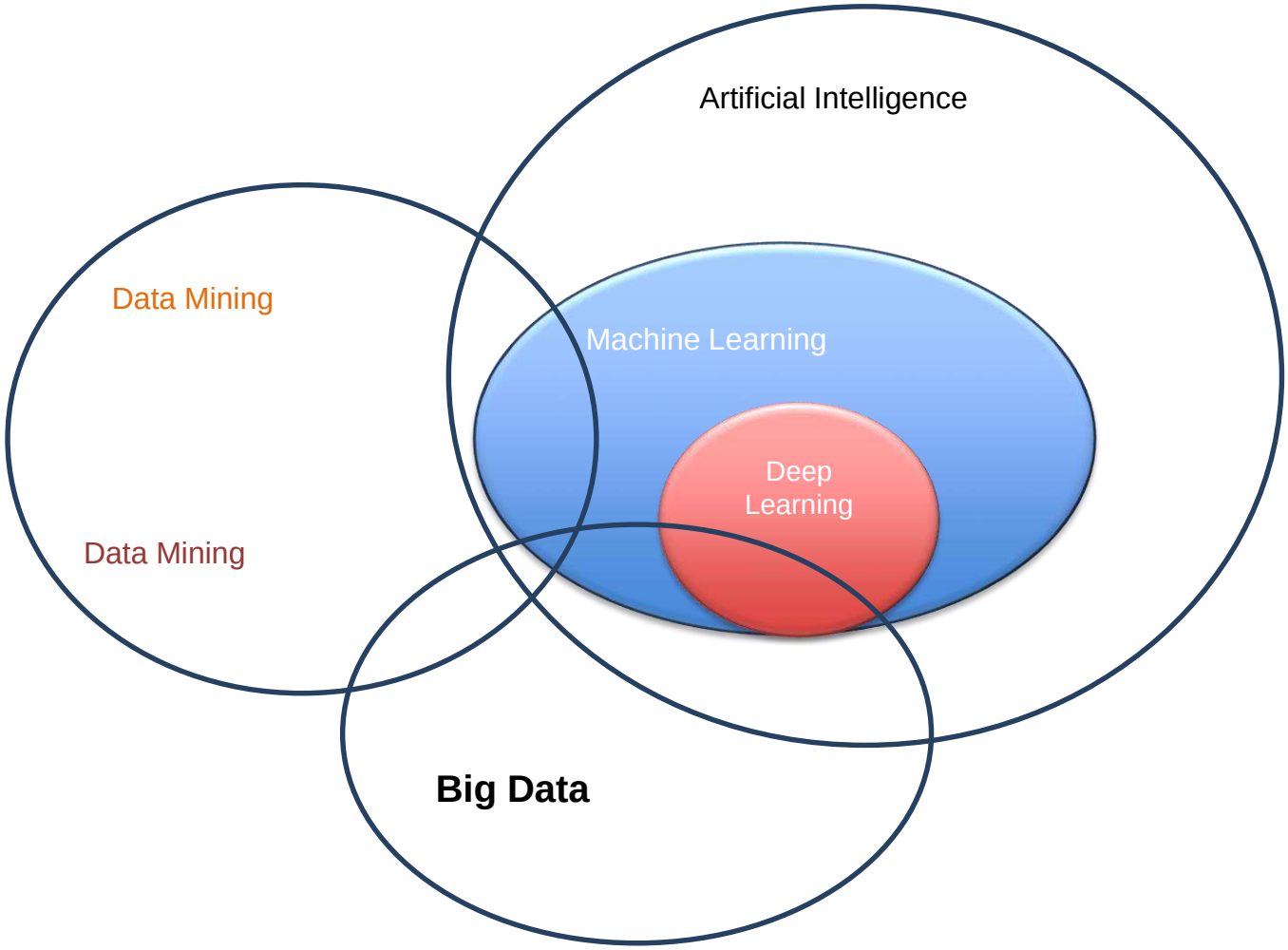


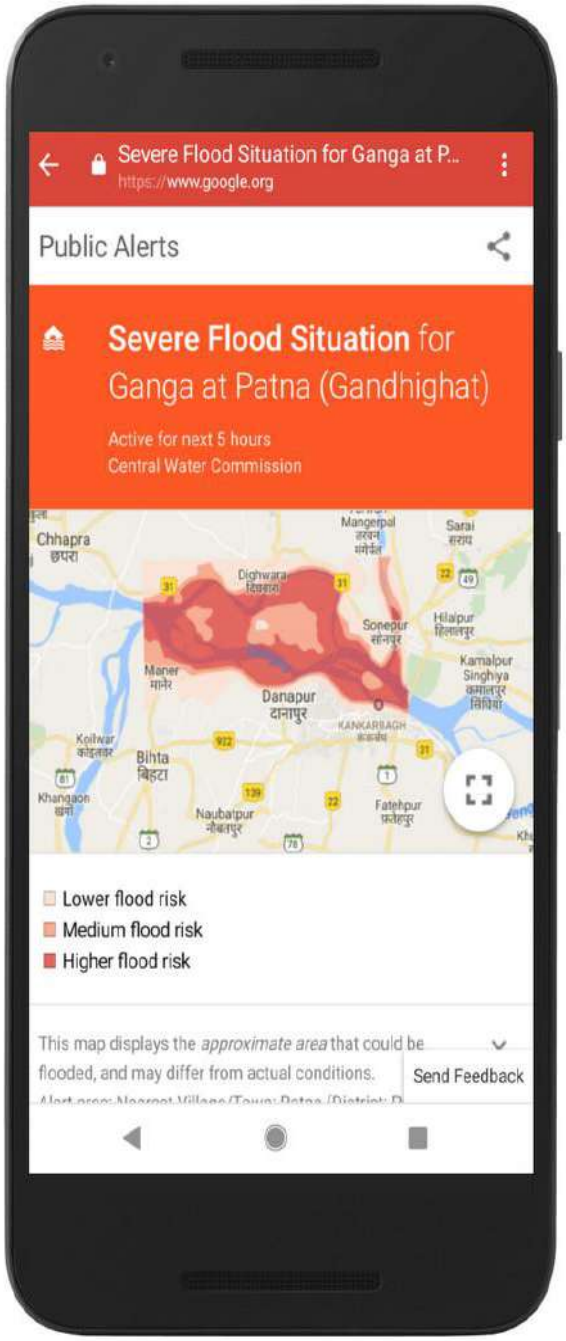
Sites of seismic intensity meters

Startups like Zizmos (Stanford University), using IoT by interconnecting multiple seismic sensors in high-risk areas, detects motion close to the earthquake epicenter and transmits a warning alert to users further away from the epicenter. It uses smartphone apps with cloud messaging services provided by Apple and Google

Emerging trends:

Big Data and its interface with Machine Learning





Global Google Public Alerts program (Big Data and Machine Learning)

AI-assisted flood predictions

AI and significant computational power to create better forecasting models through Google Public Alerts. A variety of elements—from historical events, to river level readings, to the terrain and elevation of a specific area—feed into these models.

It generates maps and run up to hundreds of thousands of simulations in each location to accurately predict not only when and where a flood might occur, but the severity of the event as well.

Three Key challenges

Big Data Collection

Challenges of dealing with large variety of heterogeneous data from different data sources- from sensors to crowdsourcing, including time series, semi-structured and invalidated data, and textural data; also noise and misinformation.

Big Data Analytics

Analytics yet to integrate reliably and accurately Crowdsourced data, from the disaster affected people, into the physical sensing data (e.g., satellite, UAV) and authoritative data (e.g., terrain data, census data).

Cyberinfrastructures

It's important for effectively integrate huge data from multiple sources for real-time decision making in the context of the emerging data volume of streaming videos, fast data transfer, and intuitive data visualization.

Thank you for kind attention

Sanjay K Srivastava
Chief, Disaster Risk Reduction
ICT and Disaster Risk Reduction Division (IDD)
United Nations Economic and Social Commission for Asia and the Pacific
Office: +6622882633 | srivastavas@un.org
www.unescap.org