

# Artificial Intelligence and Machine Learning

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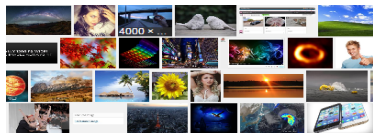
Full Professor (CSE)

IEEE Fellow

Machine learning, Artificial intelligence

- **Associate Editors:** IEEE Transactions on Neural Networks and Learning Systems / Neural Networks / Neurocomputing / International Journal of Data Science and Analytics
- **Area Chairs** of major machine learning / AI conferences including NeurIPS/NIPS, ICML, ICLR, IJCAI, AAAI, ECML
- **Vice President**, Asia Pacific Neural Network Society
- **Most Influential Scholar Award Honorable Mention** (for outstanding and vibrant contributions to the field of AAAI/IJCAI between 2009 and 2019)

# AI is Everywhere



(a) image processing



(b) natural language processing



(c) speech recognition



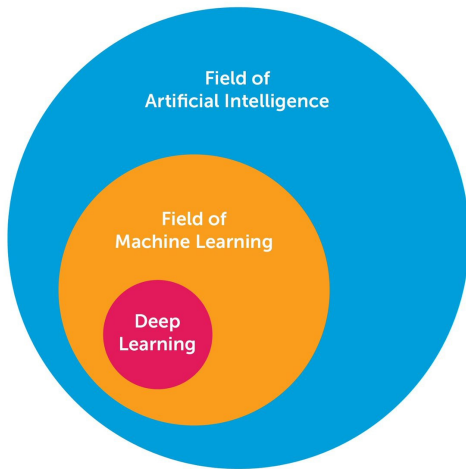
(d) game playing

AI as National Strategy in China

新一代人工智能产业三年行动计划(2018-2020)

by 2030: China become the **world's premier AI innovation center**

# AI / Machine Learning / Deep Learning



# Research Interests

## Learning paradigms

- supervised learning, unsupervised learning, reinforcement learning, semi-supervised learning, self-supervised learning, ...
- multiclass / multilabel / multi-instance / multitask ...

## Machine learning models

- deep networks, support vector machines, Bayesian models, ...

## Learning from high-dimensional data

- dimension reduction, sparse learning, metric learning, manifold learning, ...

# Research Interests...

## Learning from big data

- scalable machine learning algorithms, online learning, ...

## Learning from small samples

- transfer learning, few-shot learning, active learning, data augmentation, meta-learning ...

## Different types of data

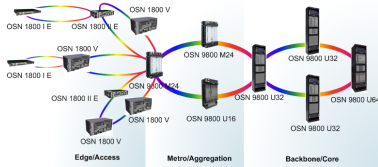
- timeseries, images, multispectral images, graph-structured data (networks), ...

## Different types of platforms

- single machine, distributed machine learning

# AI/ML in Networking

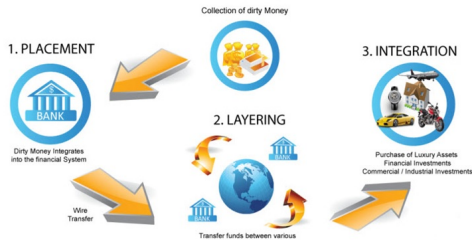
*Huawei*



- use AI/ML to improve network performance

## WeBank

- anti-money laundering



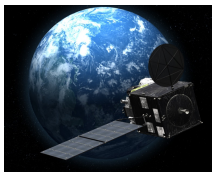
- almost all existing systems are rule-based
  - Alert if “in past 5 days, customer has at least HKD500,000 wired-in” **AND** “total withdrawn amount is 90-110% of total wired-in amount” **AND** “current day withdrawal is at least HKD100,000”
- significant improvement by using AI/ML



# AI/ML in Environment

## Hong Kong Observatory and Hong Kong Airport Authority

- detect upper air **aviation turbulence** based on multispectral satellite imagery and aircraft data

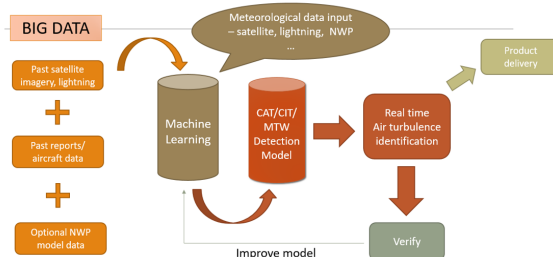
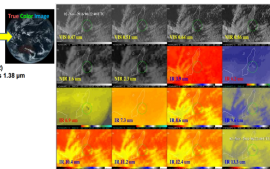


any of MTWAT-10/2

	Band	Wavelength (µm)	Quantization (bit)	Spatial Resolution (km)
VIS	1	0.46	11	15km
	2	0.66	11	15km
	3	0.86	11	15km
	4	0.96	11	15km
	5	1.6	11	25km
	6	2.3	11	25km
IR4	7	3.9	14	25km
	8	6.2	11	25km
	9	7.0	11	25km
	10	7.3	12	25km
IR5	11	8.6	12	25km
	12	9.6	12	25km
	13	10.4	12	25km
	14	11.3	12	25km
IR2	15	12.3	12	25km
	16	13.3	11	25km

Similar to ABI for GOES-R  
RGB band Composited  
0.51 µm (Band 2) instead of ABI's 1.38 µm

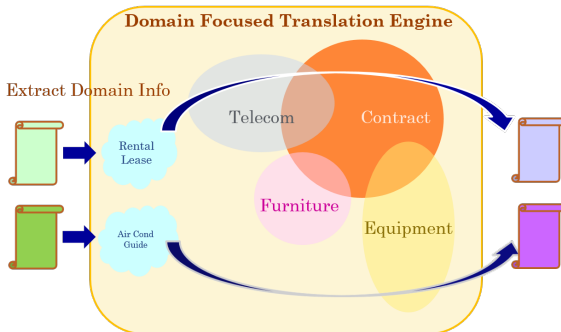
Water vapor  
SO<sub>2</sub>  
Atmospheric Windows  
CO<sub>2</sub>



# AI/ML in Language Processing

## *Logistics and Supply Chain MultiTech R&D Centre*

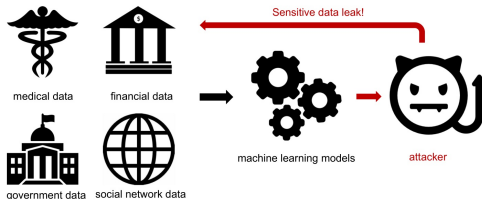
- Hong Kong to become the arbitration venue under “One Belt One Road” → legal documents
- **neural machine translation**



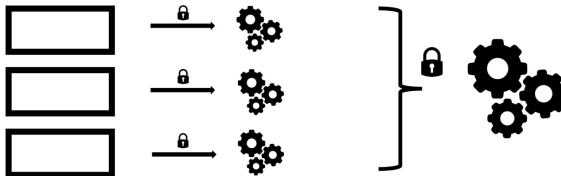
# AI/ML in Cross-Organizational Applications

## 4Paradigm

- data privacy



- cross-organizational: data in different organizations
- federated learning



# Other Example Applications

- product recommendation (content-based / collaborative filtering)
- link prediction
- indoor / outdoor location estimation
- image processing
- document classification
- outlier detection
- compressing deep networks
- ...

# Conclusion

- AI/ML: key to modern industry transformation and innovation
- domain expertise + academia

create new knowledge, generate new solutions, create more value