



# **Artificial Intelligence in Myanmar: Education, Research and Development Towards Smart Cities**

**By**

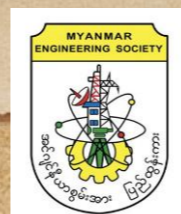
**Prof Dr. Charlie Than**

**Patron**

**Federation of Myanmar Engineering Societies**

**With**

**Yan Lin Aung & Win Khine Moe**

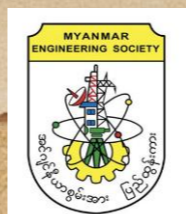






# Content

- **The Needs for AI in Myanmar**
- **Myanmar AI Community**
- **Skilled AI Workforce in Myanmar**
- **R&D Projects with AI/Machine Learning**
- **Roads Ahead for AI in Myanmar towards Smart Cities**

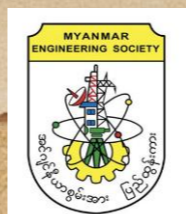






# The need for AI in Myanmar

- Myanmar is the last untapped market with fastest growing economy in Asia
- Critical shortage of skilled workforce to accelerate change and development in Myanmar
- Younger generation has genuine interest in technological and digital solutions including Artificial Intelligence/Machine Learning
- Development of AI/ML is not an option rather a necessity to help reduce poverty, rising inequalities, urban-rural divide, citizen security and safety

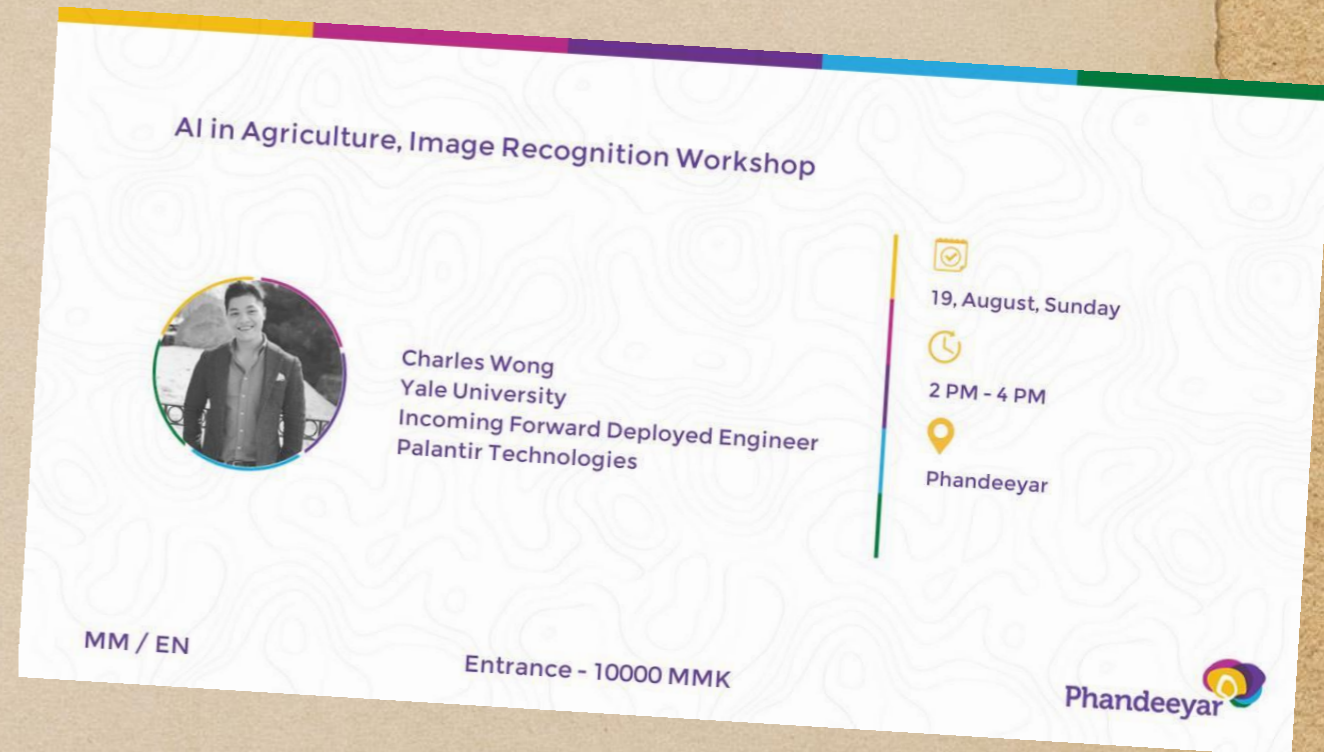




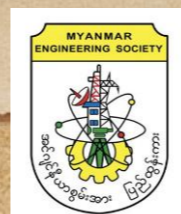


# Myanmar AI/ML Community

“Artificial Intelligence & Machine Learning (Myanmar)” Facebook group with more than 2K members



Knowledge sharing events hosted by Phandeeyar – an innovation lab in Myanmar (<https://phandeeyar.org/>)







# Things Talk

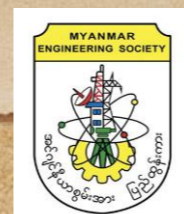
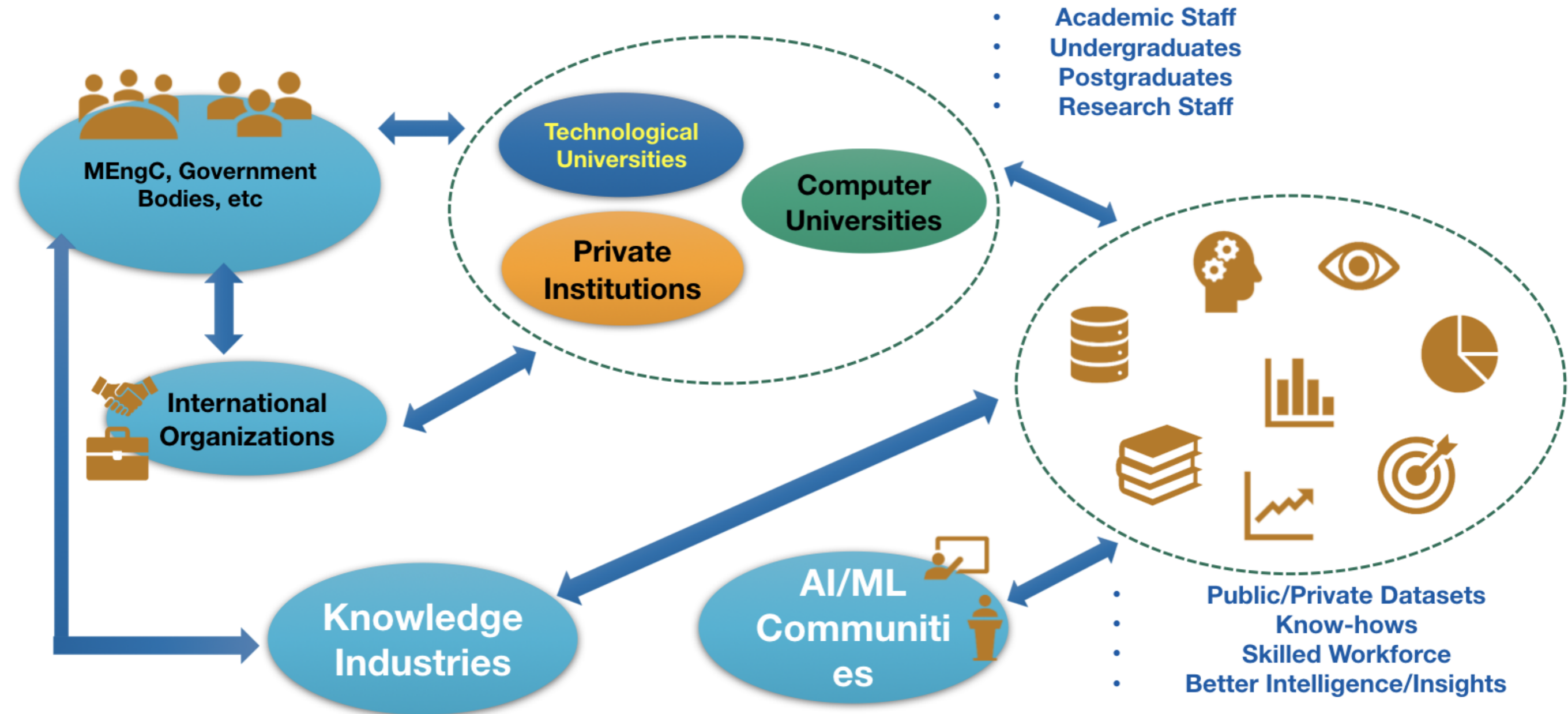
- One day seminar at University of Information Technology (UIT) on 22 Jun 2018
- Topics Covered: AI/Machine Learning, Big Data, Internet of Things (IoT), Cyber Security, Smart City, Blockchain







# Skilled AI Workforce in Myanmar

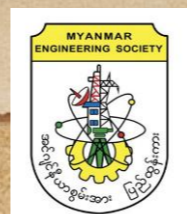






# **R&D Projects with AI/Machine Learning**

- **Automatic Vehicle License Plate Recognition System for Smart Transportation**
- **Smart Air Quality Monitoring System with LoRaWAN and Time Series Prediction**
- **Automatic Pulmonary Nodule Detection from Radiography using AI**
- **Security Surveillance System With Intelligence Computer Vision**
- **Natural Language Processing (NLP) Project**
- **Image Processing Project**
- **Robotic Project**
- **Unmanned Aerial Vehicles (UAV) Projects**





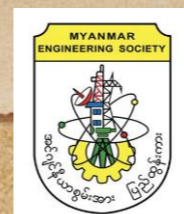


# Automatic Vehicle License Plate Recognition System for Smart Transportation

- 1<sup>st</sup> in Myanmar having a dataset of actual license plate images and successful system implementation



- Essential for automatic highway toll collection, theft prevention, enforcement of traffic rules, logistics management, security monitoring of roads and checkpoints

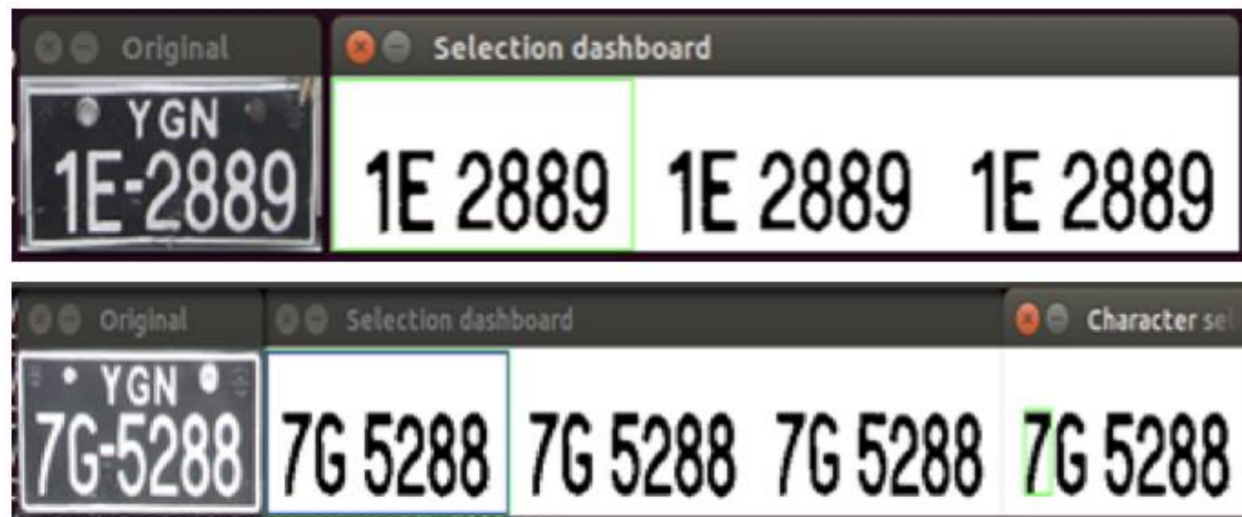




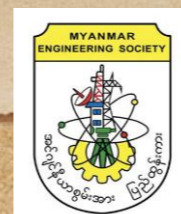
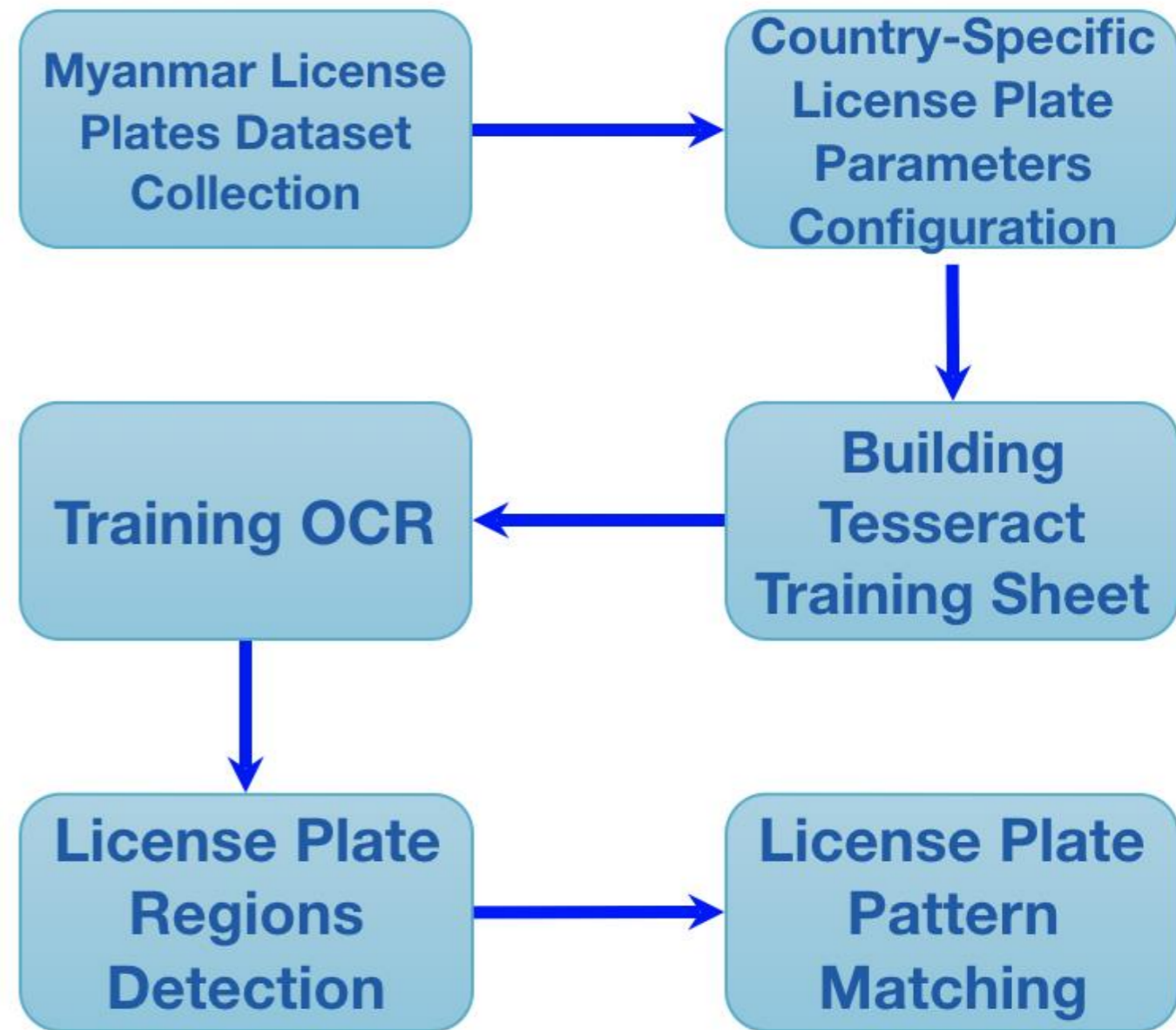
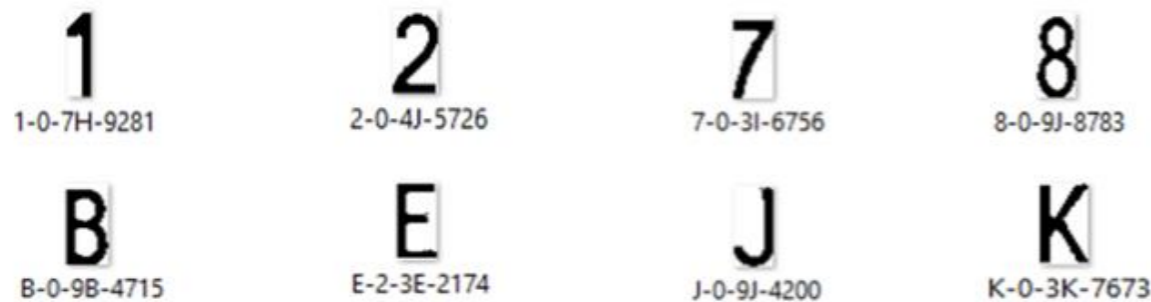


# System Implementation

## License Plate Analysis



## Classified Characters







# Experimental Result

90% accuracy for recognizing characters  
Able to detect all license plates in the video



```
Total Time to process image: 653.049ms.
plate0: 10 results -- Processing Time = 24.0127ms.
- 4J5208 confidence: 90.8175 pattern_match: 1
- 4J5208 confidence: 82.9507 pattern_match: 0
- 4J52Q8 confidence: 81.975 pattern_match: 0
- 4J52D8 confidence: 80.4053 pattern_match: 0
- 4JS208 confidence: 80.2739 pattern_match: 0
- 4J52U8 confidence: 76.166 pattern_match: 0
- 4J52G8 confidence: 75.8905 pattern_match: 0
- 4JS208 confidence: 72.407 pattern_match: 0
- 4JS2Q8 confidence: 71.4313 pattern_match: 0
- 4JS2D8 confidence: 69.8617 pattern_match: 0
```



```
Total Time to process image: 231.181ms.
plate0: 10 results -- Processing Time = 27.897ms.
- AA1032 confidence: 89.8896 pattern_match: 1
- AAT032 confidence: 82.3703 pattern_match: 0
- AA1032 confidence: 81.2524 pattern_match: 0
- AA1Q32 confidence: 80.818 pattern_match: 0
- AA1D32 confidence: 79.2339 pattern_match: 0
- AA10S2 confidence: 79.1649 pattern_match: 0
- AA10B2 confidence: 76.7456 pattern_match: 0
- AA1B32 confidence: 75.6388 pattern_match: 0
- AA1U32 confidence: 74.4397 pattern_match: 0
- AA1G32 confidence: 74.1714 pattern_match: 0
```

```
Total Time to process image: 625.948ms.
plate0: 30 results -- Processing Time = 26.1316ms.
- 6I3075 confidence: 90.0125 pattern_match: 1
- SI3075 confidence: 81.6023 pattern_match: 1
- 6I3075 confidence: 80.9384 pattern_match: 0
- BI3075 confidence: 80.8123 pattern_match: 1
- 6I3Q75 confidence: 80.2049 pattern_match: 0
- 6I3075 confidence: 80.1912 pattern_match: 0
- GI3075 confidence: 79.496 pattern_match: 1
- 6IS075 confidence: 79.4851 pattern_match: 0
- 6I3D75 confidence: 78.0708 pattern_match: 0
- 6I3U75 confidence: 75.2172 pattern_match: 0
- 6I3G75 confidence: 75.1897 pattern_match: 0
- SI3075 confidence: 72.5283 pattern_match: 0
- SI3Q75 confidence: 71.7947 pattern_match: 0
- SI3075 confidence: 71.781 pattern_match: 0
- BI3075 confidence: 71.7383 pattern_match: 0
- 6I3075 confidence: 71.1171 pattern_match: 0
- SIS075 confidence: 71.075 pattern_match: 0
- BI3Q75 confidence: 71.0048 pattern_match: 0
- BI3075 confidence: 70.991 pattern_match: 0
- GI3075 confidence: 70.4219 pattern_match: 0
- 6IS075 confidence: 70.4111 pattern_match: 0
- 6I3Q75 confidence: 70.3836 pattern_match: 0
- BIS075 confidence: 70.285 pattern_match: 0
- GI3Q75 confidence: 69.6884 pattern_match: 0
- 6ISQ75 confidence: 69.6776 pattern_match: 0
- GI3075 confidence: 69.6747 pattern_match: 0
- 6IS075 confidence: 69.6638 pattern_match: 0
- SI3D75 confidence: 69.6606 pattern_match: 0
- GIS075 confidence: 68.9686 pattern_match: 0
- BI3D75 confidence: 68.8706 pattern_match: 0
```

Nay Htet Lin, Yan Lin Aung and Win Kay Khaing. Automatic Vehicle License Plate Recognition System for Smart Transportation. (Submitted)

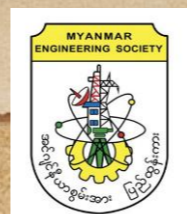






# **Smart Air Quality Monitoring System with LoRaWAN and Time Series Prediction**

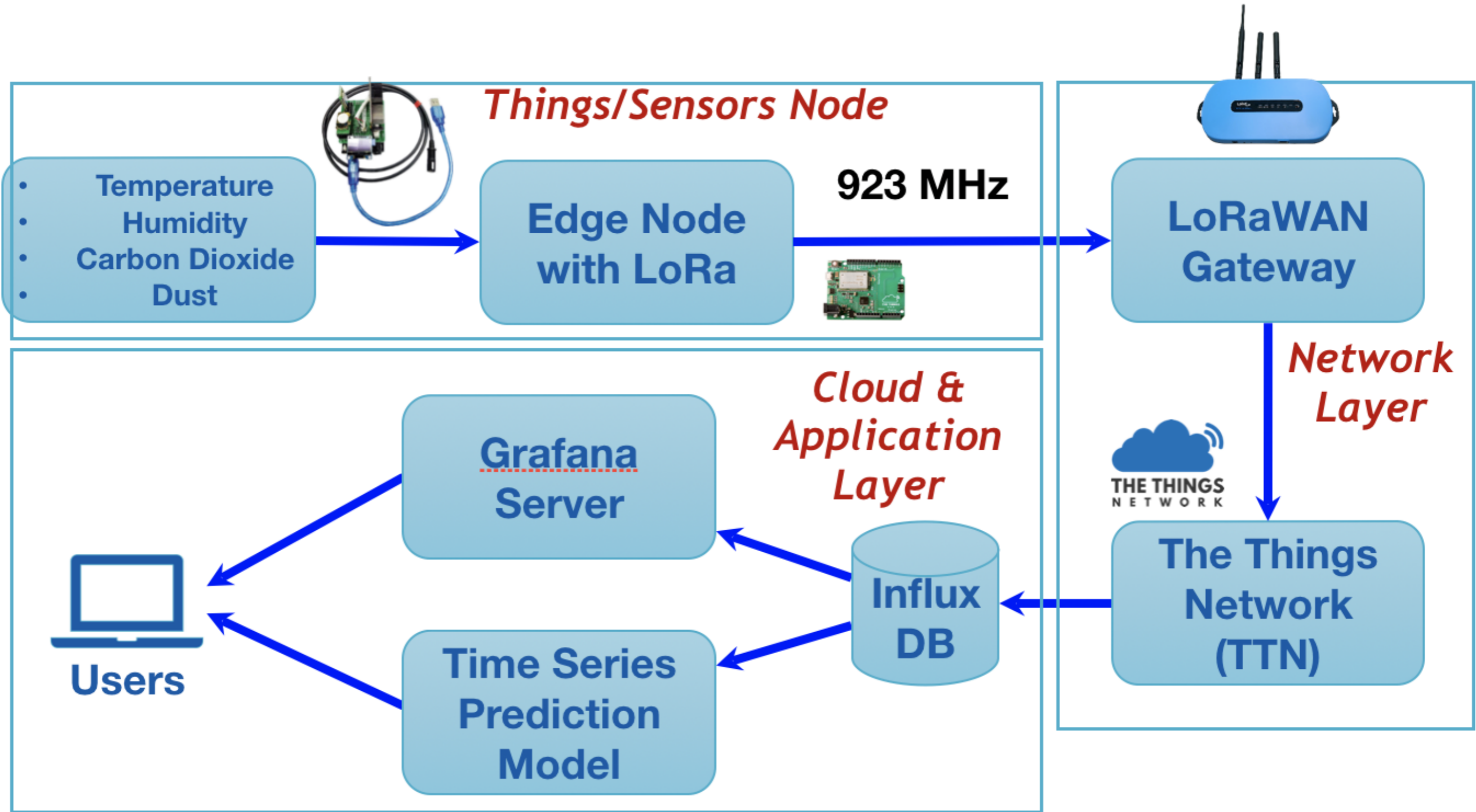
- **Cities around the globe are transforming into smart cities**
- **Need to address environmental concerns such as air pollution**
- **A scalable and cost-effective air quality monitoring system is imperative**
- **Smart Air Quality Monitoring System (SAQMS) with long-range communication capability has been implemented and deployed in Yangon since June 2018**
- **Incorporated a machine learning model to make predictions of air quality parameters**







# System Architecture



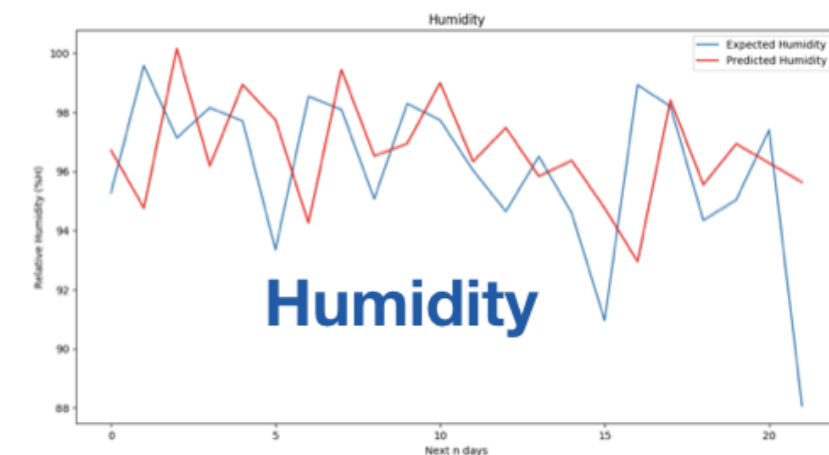
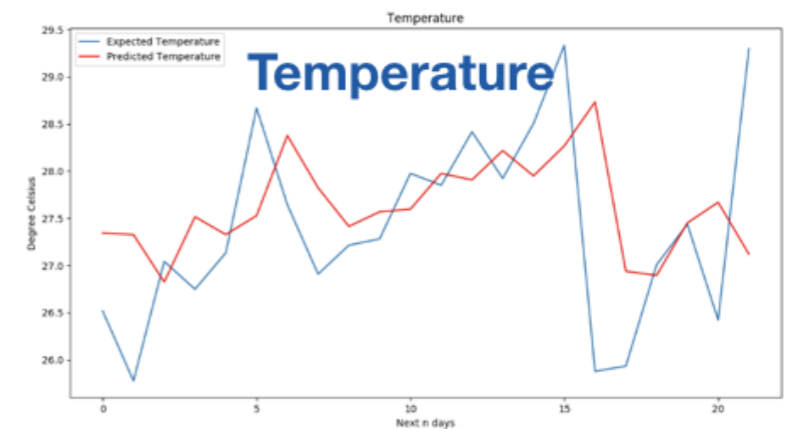
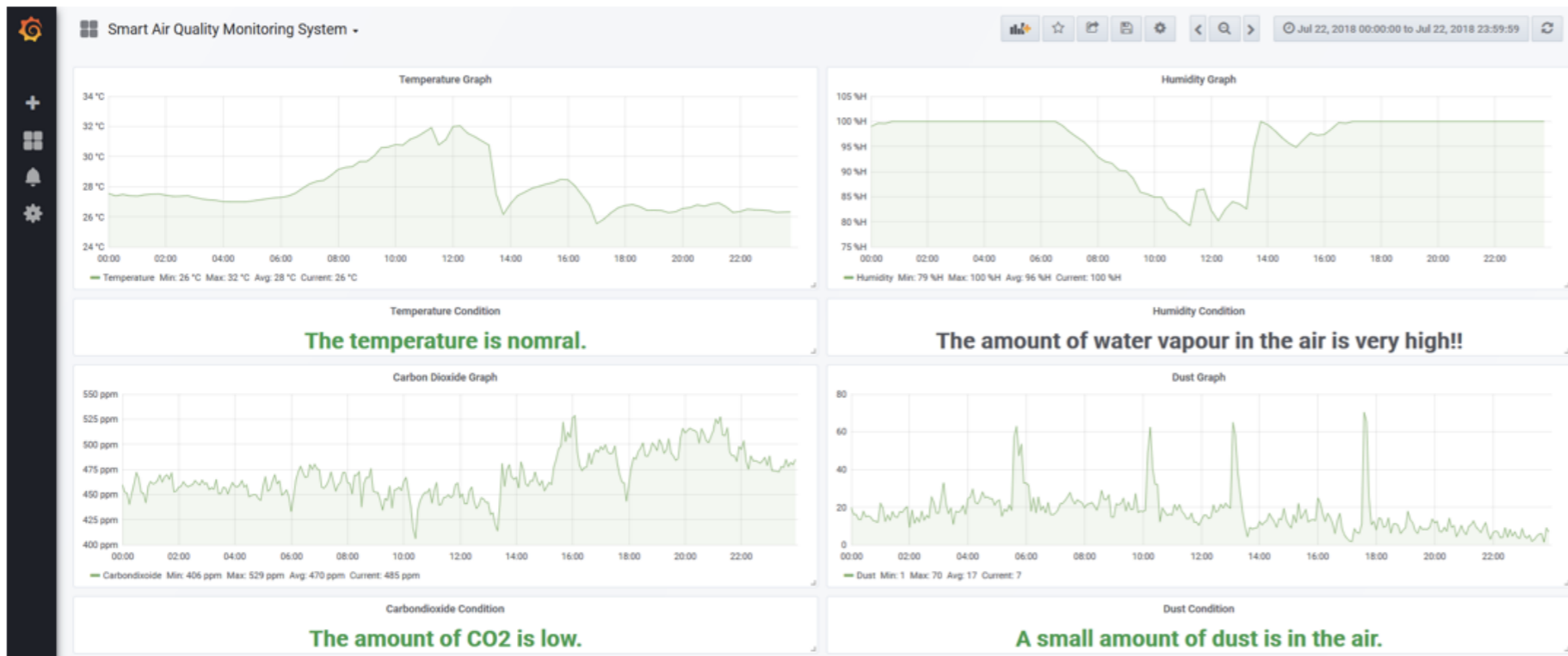




# Experimental Result

- MSAQMS has been live for 3 months in Myanmar
- Log in with Gmail at <https://thingsmm.com:3000>
- 24 hours air quality at Yangon on 22 Jun 2018

MAuto-Regressive Integrated Moving-Average (ARIMA) time series predictions of temperature and humidity for next 17 days



Min Ye Thu, Yan Lin Aung, Pyone Ei Ei Shwe and Nay Min Tun. Smart Air Quality Monitoring System with LoRaWAN. (Submitted)





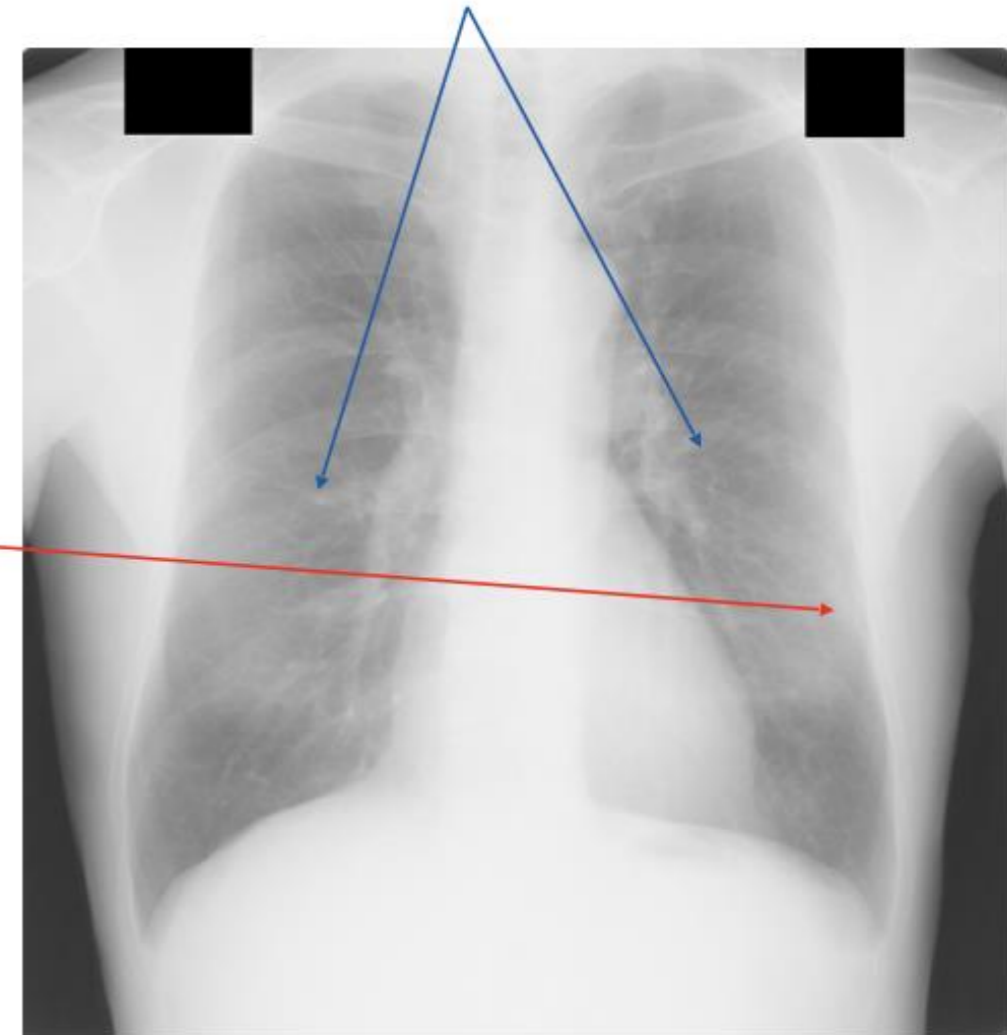


# Automatic Pulmonary Nodule Detection from Radiography using AI

- Lung related diseases are among the top leading causes of death globally
- Skilled radiologists are required to interpret X-rays images
- Computerized nodule detection systems is needed in rural areas where qualified medical personnel are rare
- Automatic pulmonary nodule detection has been a challenging problem

*Examples of regions that appear to be nodules*

*Real nodule*



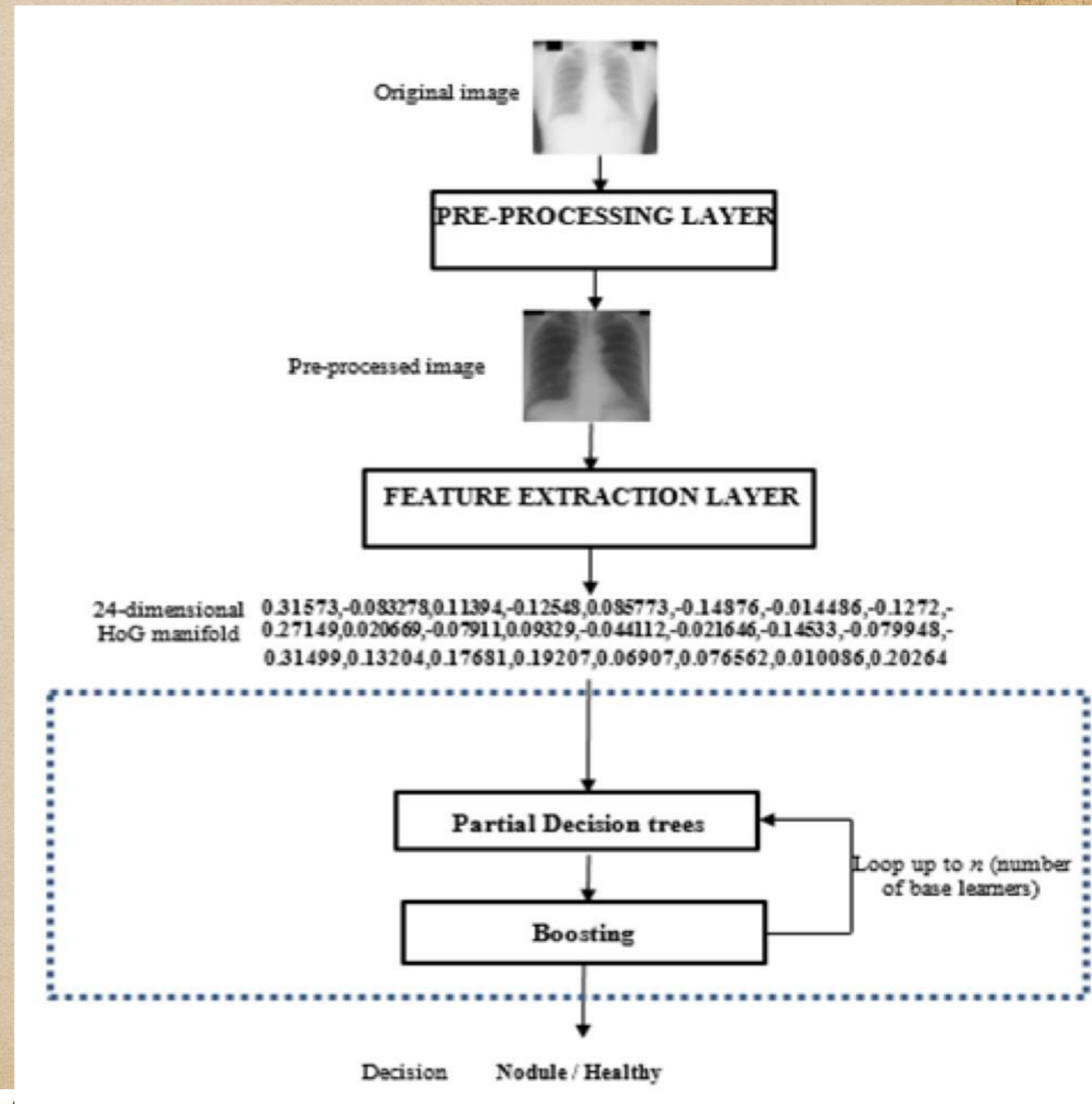




# Image Classification Methodology

Propose three-layered framework to perform automatic diagnosis of pulmonary nodules

1. Haar-wavelet based image enhancement and contour-based lung field segmentation
2. Histogram of Oriented Gradient on the pre-processed X-ray image and dimensionality reduction using codec manifold neural network
3. Classification with ensemble partial decision trees



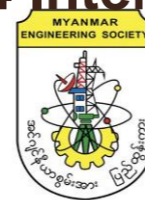




# Experimental Result

	Existing Systems			Proposed system
	Authors	Accuracy	Statistics	
<b>Japanese Society of Radiology Dataset</b>	<del>Al Abei et al. (2013) *</del> <del>Udeshani et al. (2011) *</del> <del>Al Abei et al. (2012) *</del> Devi (2014) Z. Shi et al. (2013) Patil and Kuchanur (2012) Al Gindi et al. (2014) Dey and Muctadir (2014) Kawaguchi et al. (2010) Nagata et al. (2013) Sheng et al. (2011) Shen and Suzuki (2013) Orbán et al. (2010) Gergely and Horváth (2012)	100.00% 96.00% 96.00% 85.00% 85.00% 83.30% 80.00% 76.10% 73.80% 69.70% 69.60% 66.70% 61.00% 60.20%	$\mu = 78.74\%$ $\sigma = 12.86\%$	<b>89.88%</b>
<b>Montgomery County Dataset</b>	Jaeger et al. (2013)	78.30%	-Not applicable-	<b>88.33%</b>
<b>Mandalay Dataset</b>	-Not applicable-	-Not applicable-	-Not applicable-	<b>100.00%</b>

Htike, Z. Z., Naing, W. Y. N., Win, S. L., & Khan, S. (2014, September). Computer-Aided Diagnosis of Pulmonary Nodules from Chest X-Rays Using Rotation Forest. In Computer and Communication Engineering (ICCCE), 2014 International Conference on (pp. 96-99). IEEE.







# Security Surveillance System With Intelligence Computer Vision

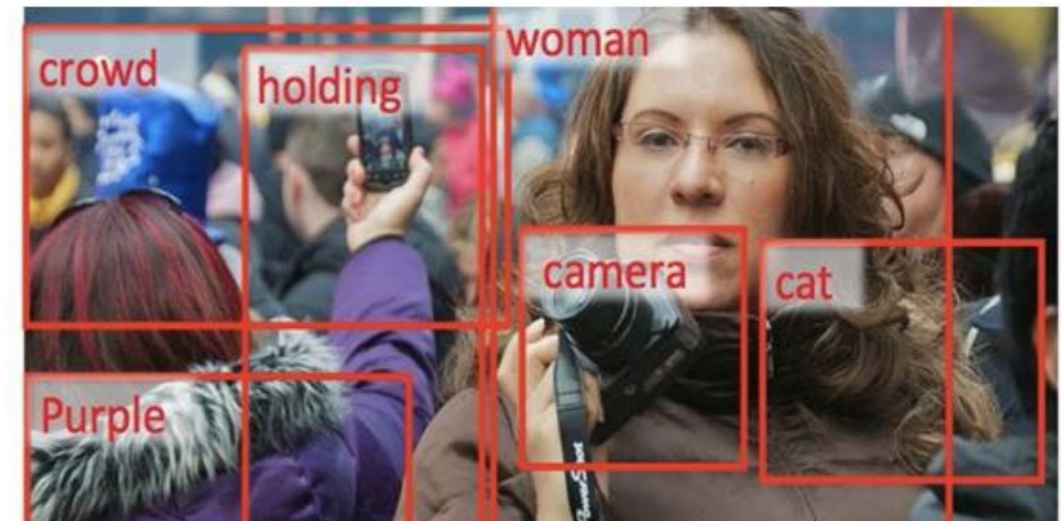
## Object Tracking



## Face Searching



## Object Recognition



## Face Recognition

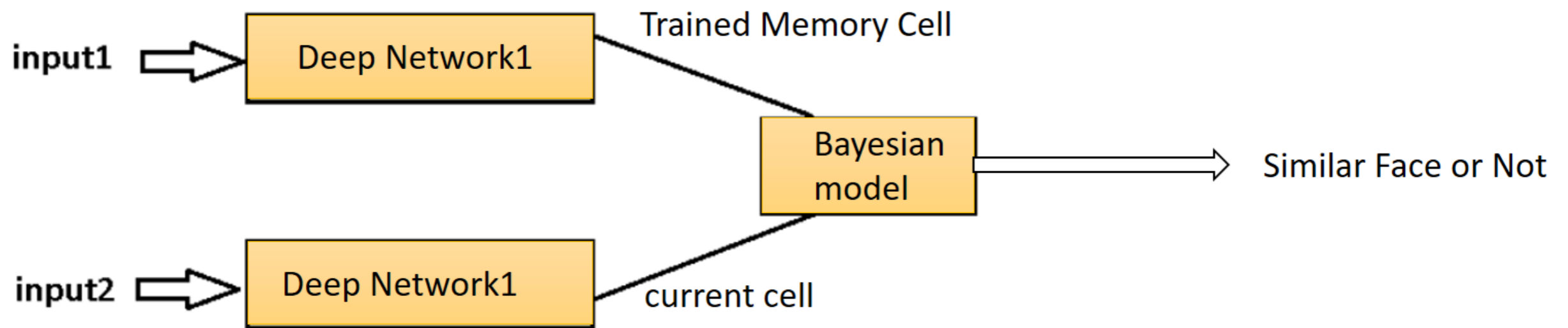






# One Shot Learning

- Images in the database pass through the pre-trained deep neural network model and produce a feature vector (Trained Memory Cell)
- The image to search is then passed through the pre-trained deep neural network and also produce a feature vector (Current Cell)
- Bayesian model is used to measure the distance between two vectors

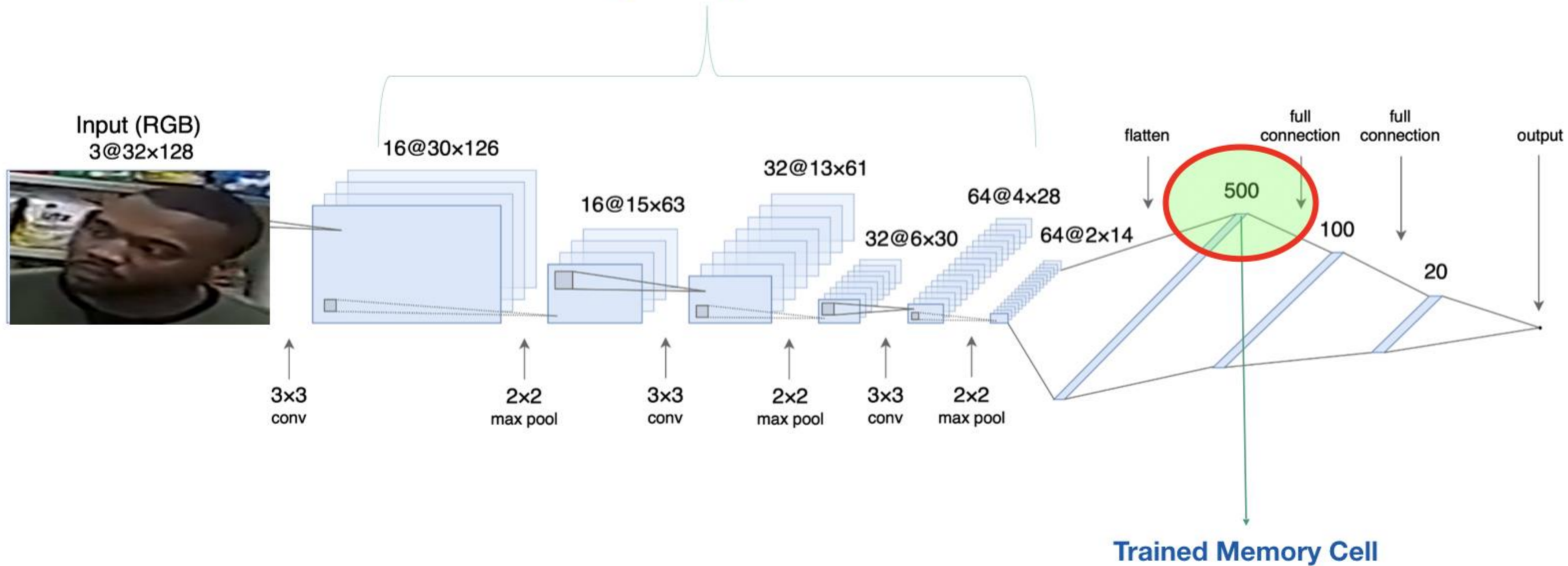




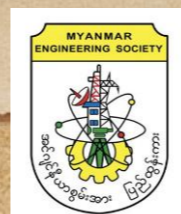


# Deep Network 1

## End-to-end Feature Learning using Inception V3



Source: Google Images

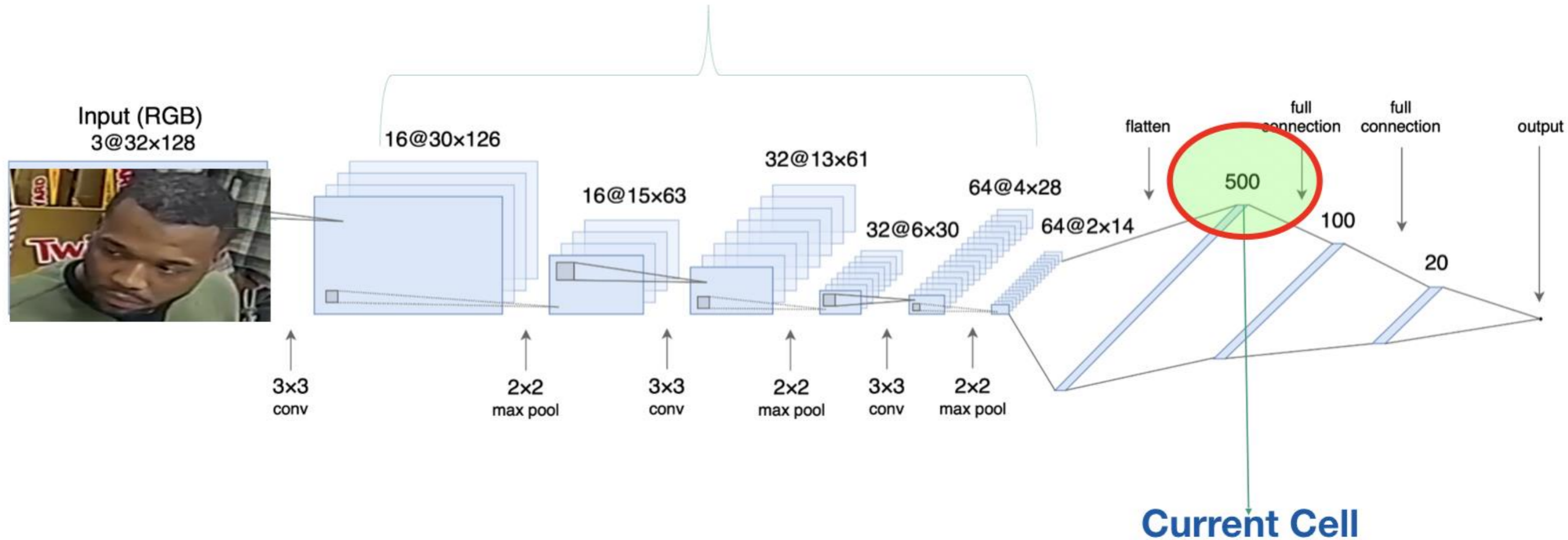




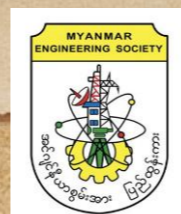


# Deep Network 2

## End to End Feature Learning Using Inception V3



Source: Google Images

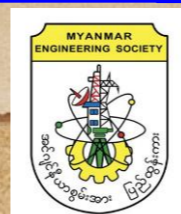






# Natural Language Processing (NLP) Project

- NLP Research Lab in University of Computer Studies, Yangon started in 2006
- Myanmar Unicode and NLP Center at Myanmar Computer Federation, Yangon
- Small group projects in institutions and universities
- Some of online NLP projects:
  - Network-based ASEAN Languages Translation Public Service (<http://www.aseanmt.org>)
  - English to Myanmar Statistical Machine Translation System ([http://www.nlpresearch-ucsy.edu.mm/NLP\\_UCSY/mtapplication.html](http://www.nlpresearch-ucsy.edu.mm/NLP_UCSY/mtapplication.html))
  - Myanmar-English-Myanmar bilingual dictionary ([http://www.nlpresearch-ucsy.edu.mm/NLP\\_UCSY/dictionaryapplication.html](http://www.nlpresearch-ucsy.edu.mm/NLP_UCSY/dictionaryapplication.html))
  - Myanmar Word Segmentation ([http://www.nlpresearch-ucsy.edu.mm/NLP\\_UCSY/wsandpos.html](http://www.nlpresearch-ucsy.edu.mm/NLP_UCSY/wsandpos.html))

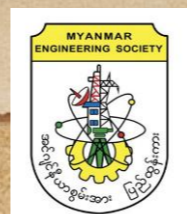






# Natural Language Processing Project

- **Domain of Project**
- **Myanmar Unicode**
- **English to Myanmar/ Myanmar to English Machine Translation**
- **Automatic Speech Recognition**
- **Text to Speech**
- **Myanmar Information Retrieval**
- **Myanmar Morphological Analysis**
- **Building Asia Language Treebank**
- **Multilingual Parallel Text Collection**
- **Myanmar Text Summarization**

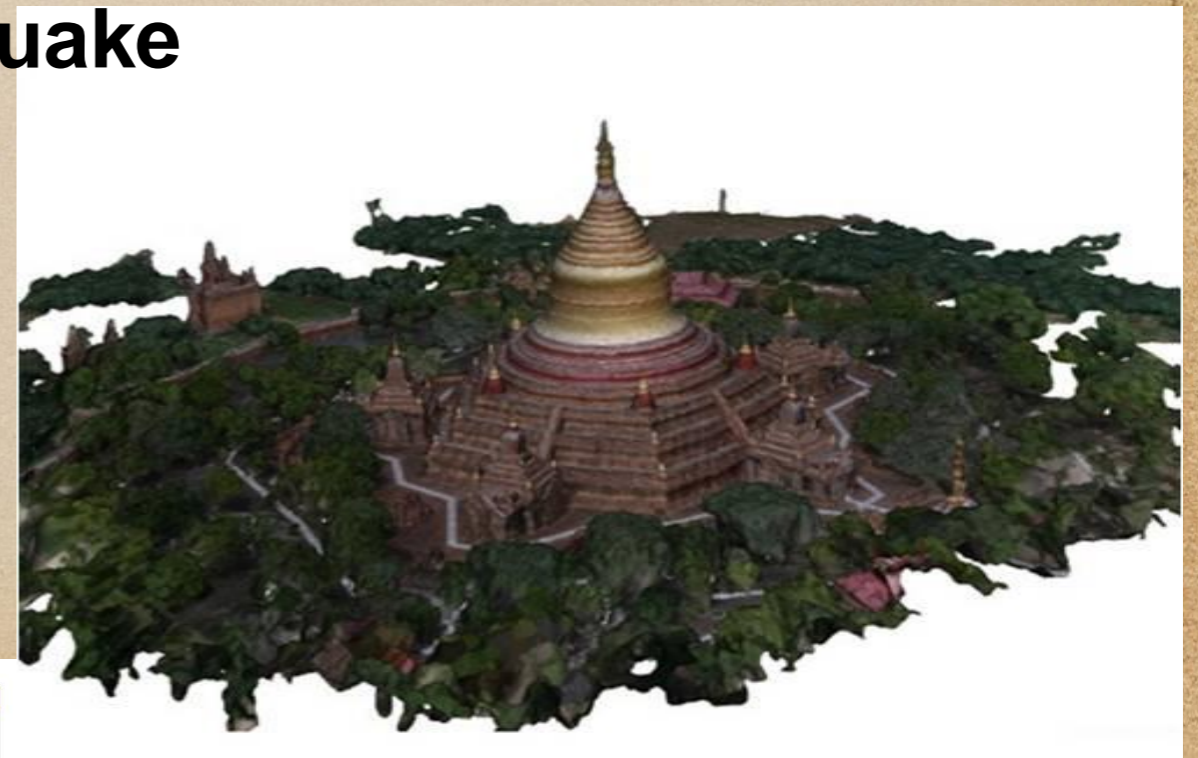






# Image Processing Project

- Image Processing Research Lab in University of Computer Studies, Yangon
- University of Computer Studies, Yangon and Myanmar Aerospace Engineering University have been collaborating to the Aerial photo survey and 3D map and 3D model producing project for providing the renovation and restoration process of Bagan pagodas which are damaged by the magnitude of 6.8 earthquake

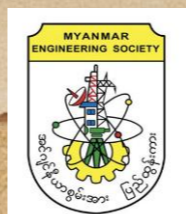






# Image Processing Project

- **Human Biometric**
- **Medical Image Processing**
- **SATELLITE Imaging**
- **Motion Detection and Camera Calibration**
- **Three Dimensional Model and Virtual Views Reconstruction**
- **Digital Image Correlation**
- **Character Recognition System**
- **3D Image Retrieval and Representation**
- **Some Ongoing Research Projects**

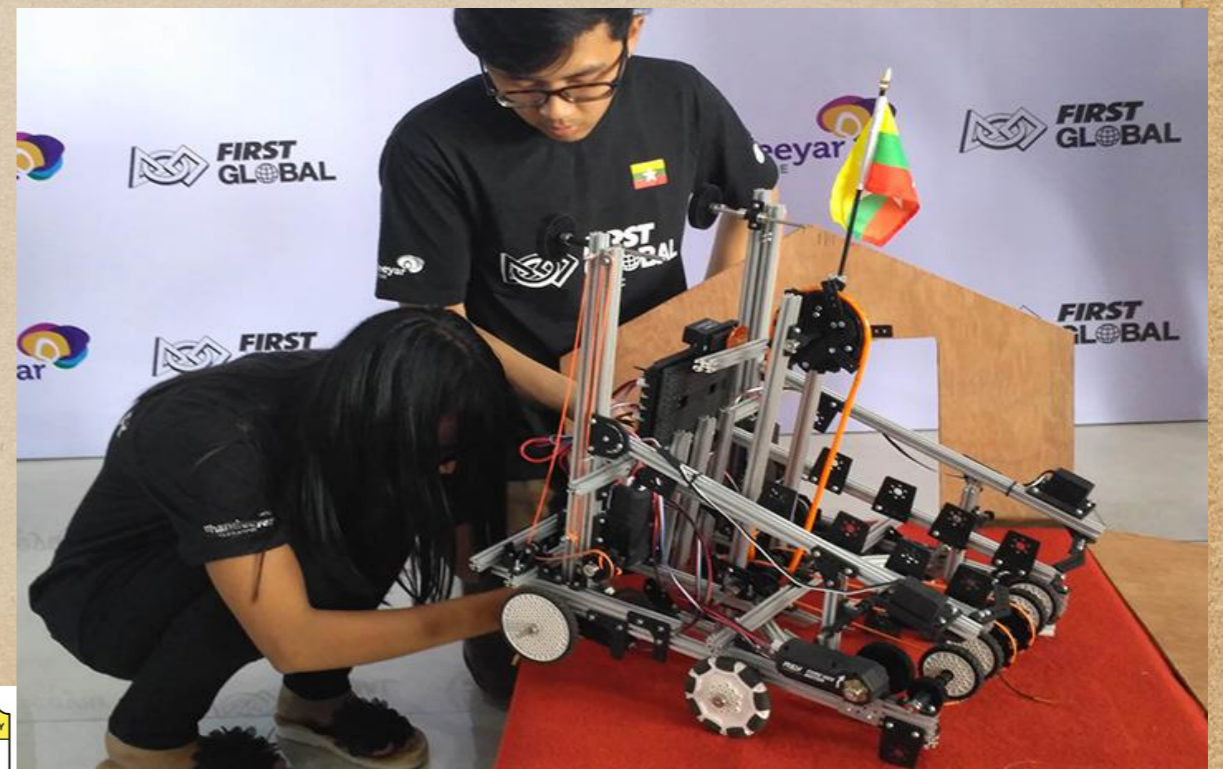






# Robotic Project

- Myanmar team ranked 6th out of 163 teams at World's first international robotics Olympics in USA from 16 July to 18 July 2017
- The FIRST Global Myanmar team included a roster of talented engineering students from Computer and Technological Universities and High School.

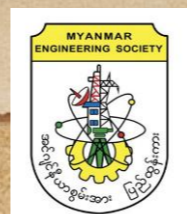






# Unmanned Aerial Vehicles (UAV) Projects

- **Auto-pilot for Unmanned Aircraft Systems and Drones**
- **The implementation team consists of pilots, engineers and students from Myanmar Aerospace Engineering University in Meikhtila**
- **Started manufacturing drones since 2009, with a team of eight.**
- **The biggest drone is about 12 feet wide and has 10 horsepower; can fly about 60 miles, with the longest flight time exceeding five hours.**
- **Targeting use of AI/ML towards autonomous flying**

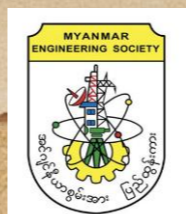






# Other Activities

- **Submission of Research and Conference Paper**
- **Conducting Ph.D and Master Thesis**
- **Workshops and Seminars**
- **Small scaled projects concerning speech recognition system, neural networks**
- **Provide equipments, trainings and solutions to technology and engineering institutes and universities to cover Sensory based System control, Process Control, Robotics and Autonomous System**

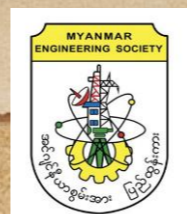






# Conclusions

- **AI related technologies change the world for the better and facilitates the life style of human**
- **Artificial Intelligence Projects are established through industry-academia-government collaboration to be targeted at developing Information Technology in Myanmar.**
- **Needs collaboration in joint workshops, seminars, trainings and research with International organizations mainly focus on intelligent machine and autonomous system**
- **Feasible Prototype: transformation of some selected part of the city to become semi-smart**







# Roads Ahead for Myanmar towards Smart Cities

- Funding and technical assistance from government and international organizations
- National Public Datasets, Private Datasets
- Data Security and Privacy Preservation
- Compute Infrastructure for AI/Machine Learning
- Seminars, Workshops, Outreach Events, Trainings, Skill Upgrading Programs, International Conferences, AI/ML Hackathons







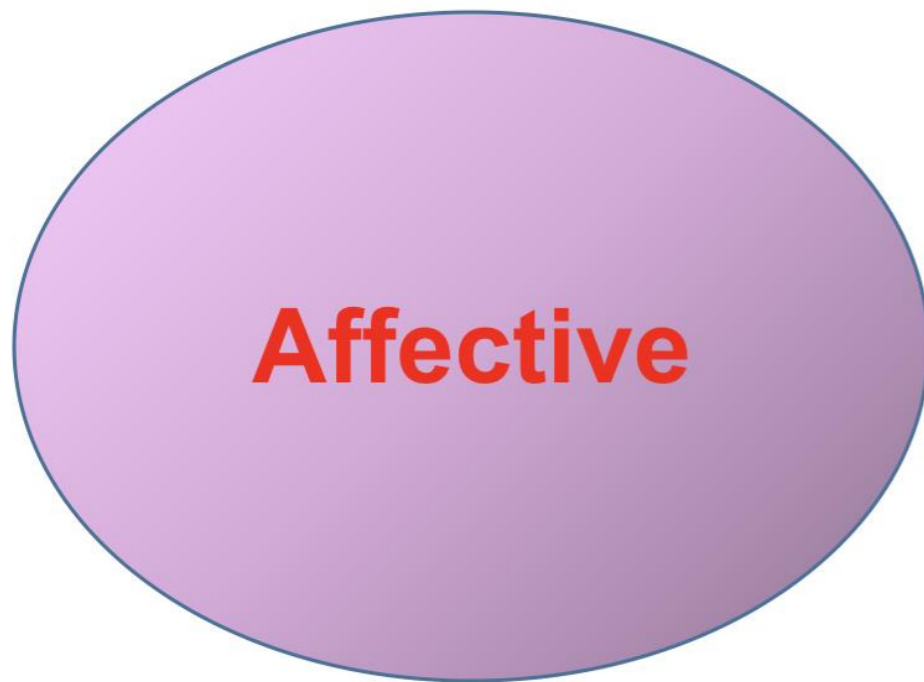
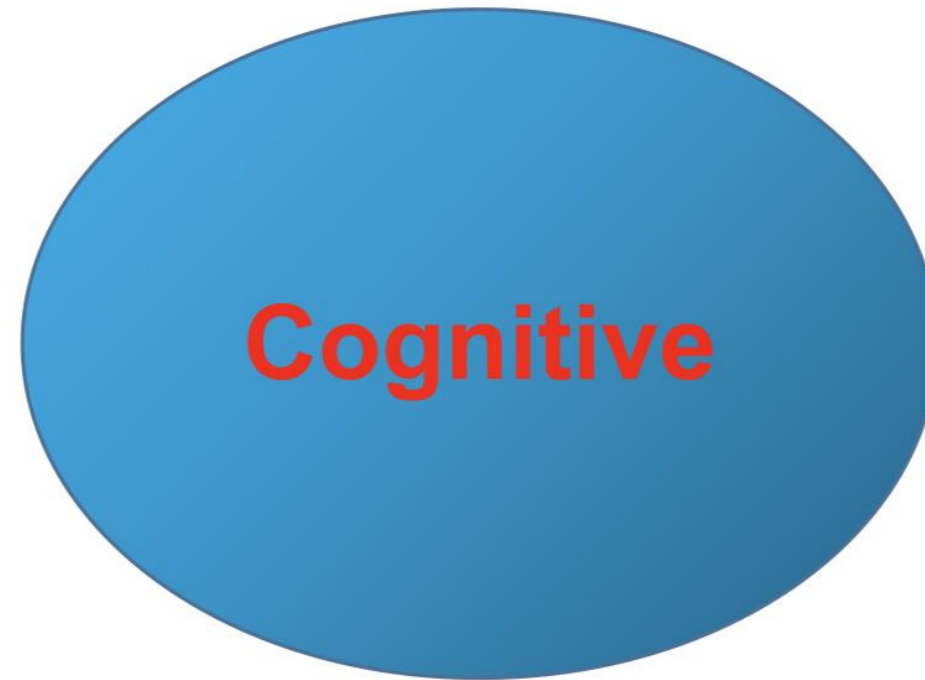
# **Annex to AI/ML towards Smart Cities**



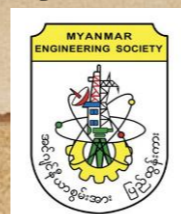




# Balanced Development Needed



## Bloom's Taxonomy of Learning Domains

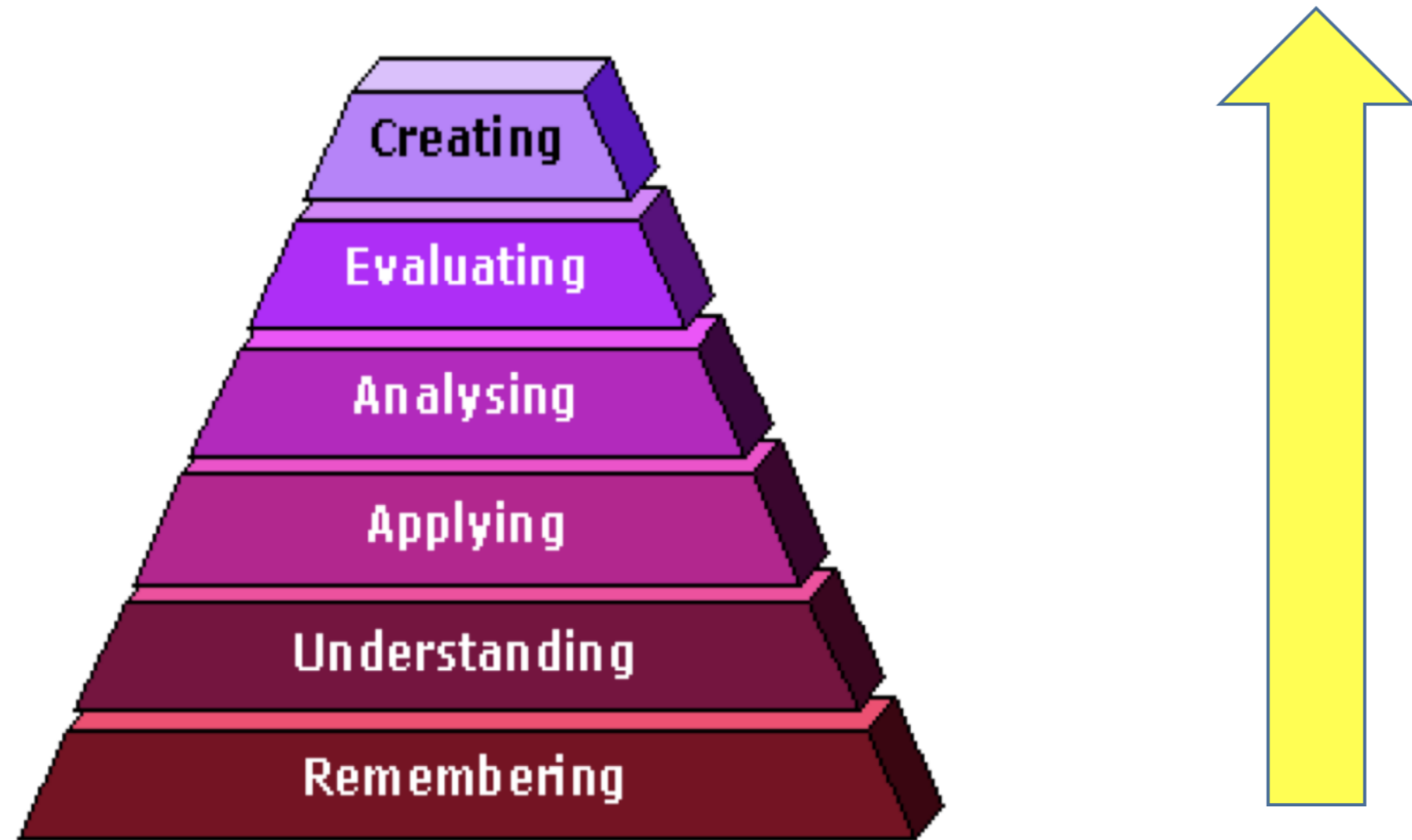




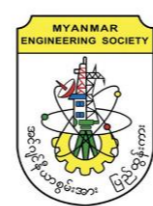


# Higher Order Development

Cognitive Domain



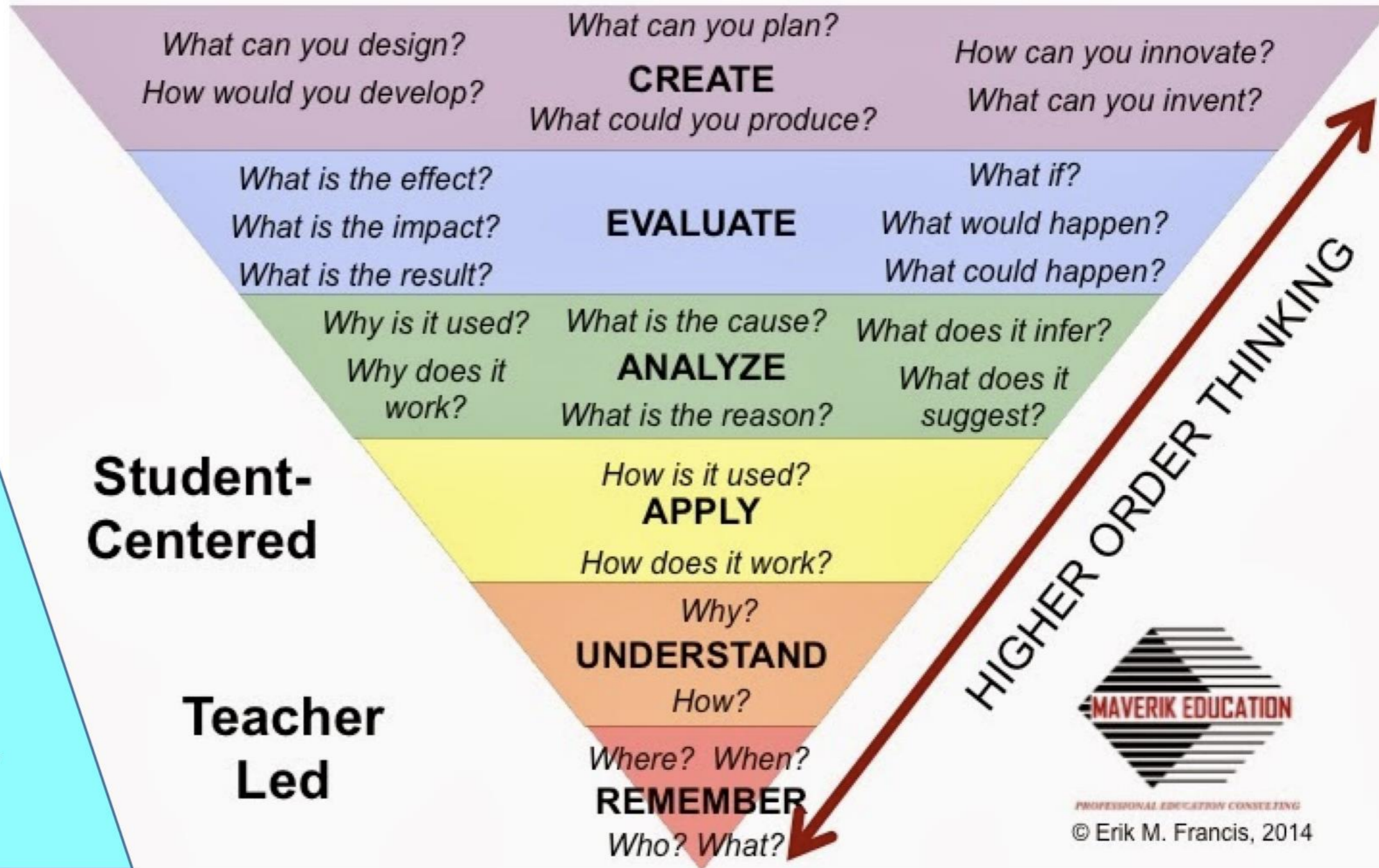
**Nowadays, everyone carries with a digital encyclopedia (smartphone) all the time. Accessing info is easy but determining right info requires cognitive skill.**



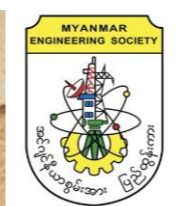




# Higher Order Thinking (Bloom's Revised Taxonomy)



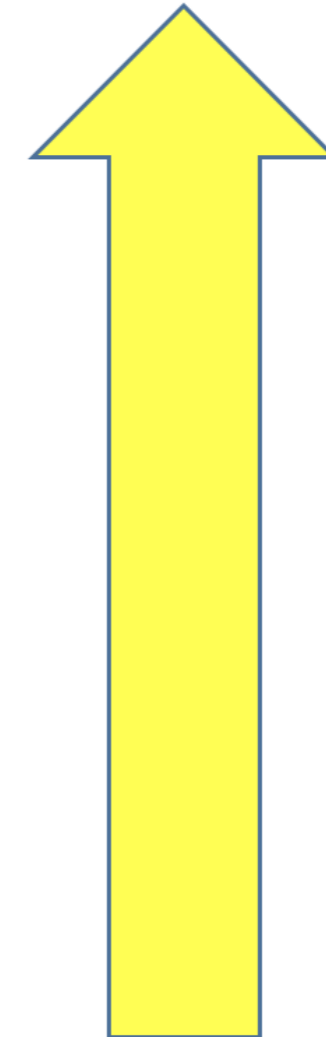
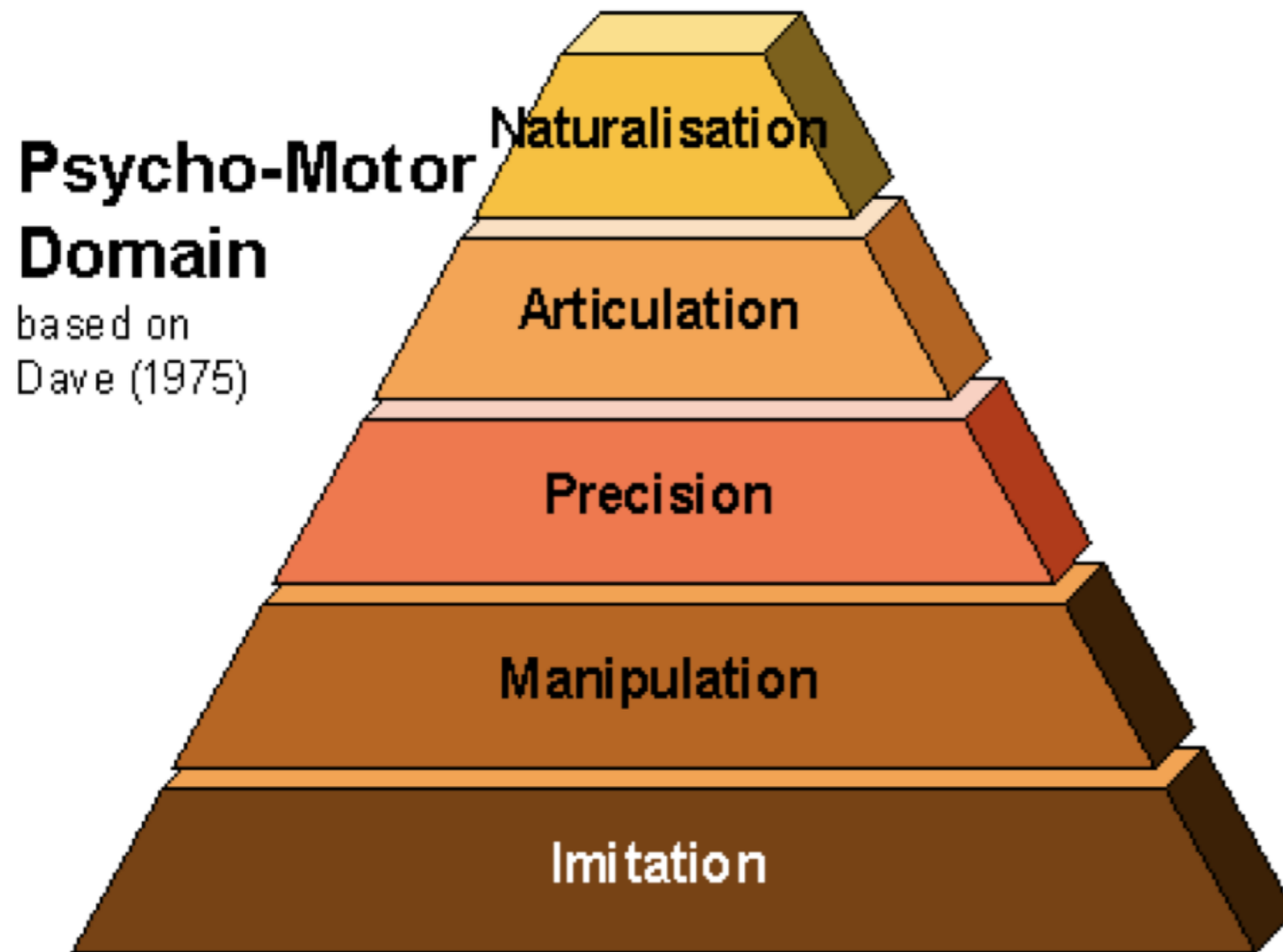
Skills rapidly acquired by smart machines/systems





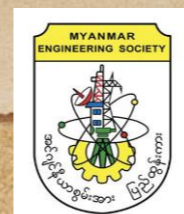


# Higher Order Development



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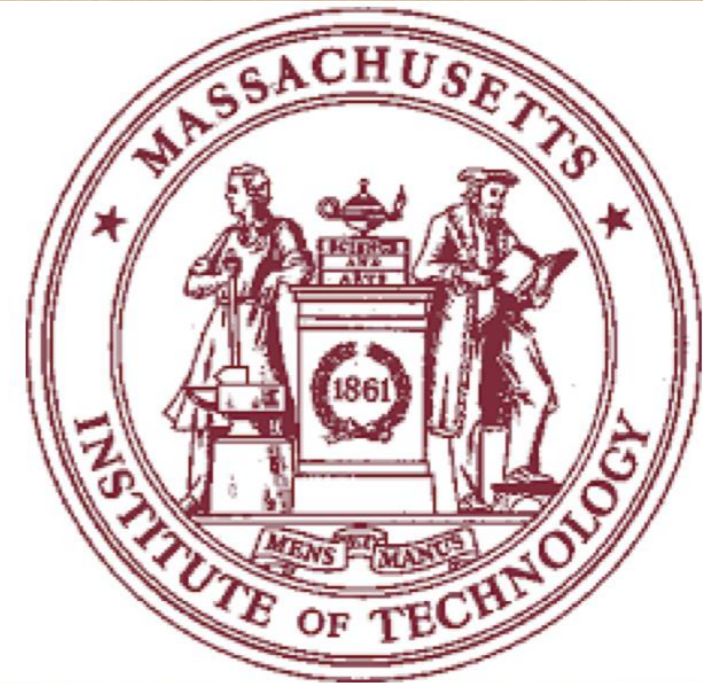
**Automation and robotics are catching up, but skilled and creative works of human are still required.**







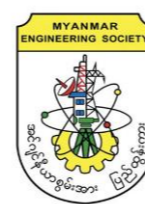
# Massachusetts Institute of Technology



**Motto:**  
**Mens et Manus**  
**(Mind and Hand)**



*30,000 companies founded by MIT alumni were active as of 2014, employing 4.6 million people and producing annual revenues of \$1.9 trillion, equivalent to the world's 10th largest economy*

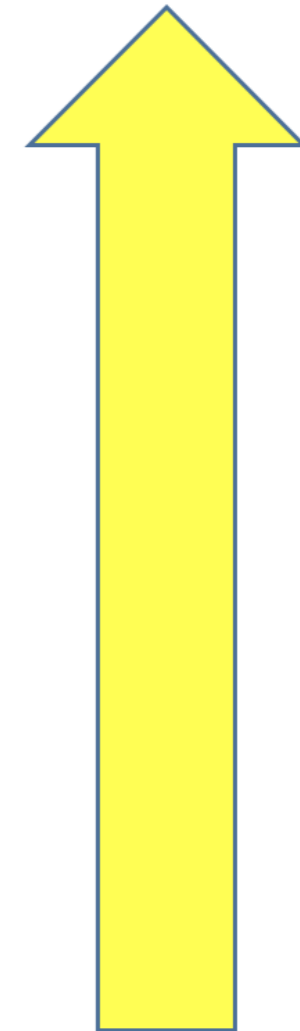
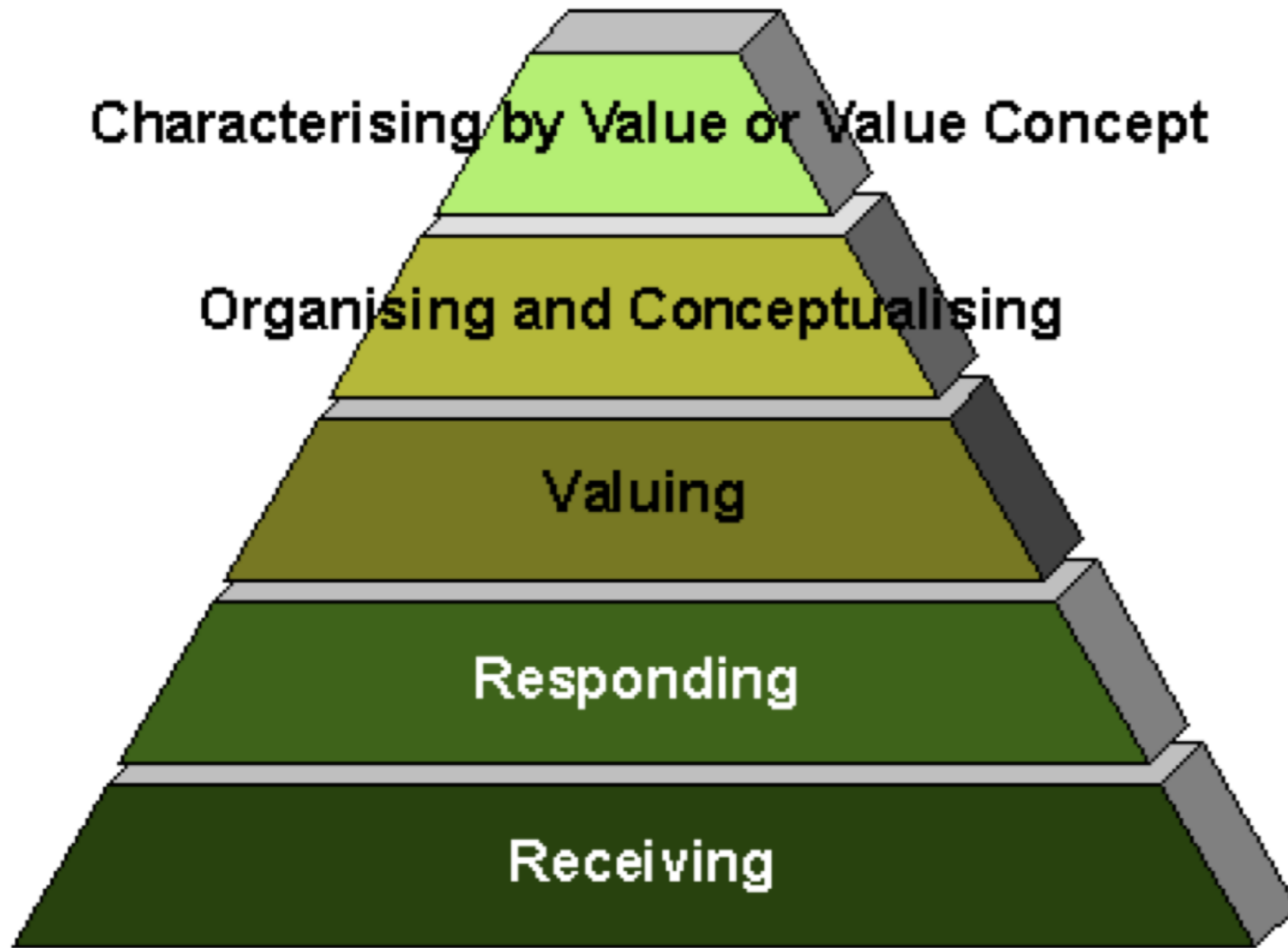






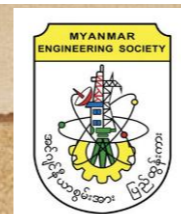
# Higher Order Development

Affective domain



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**Human touch and caring work cannot be replaced by intelligent machines.**

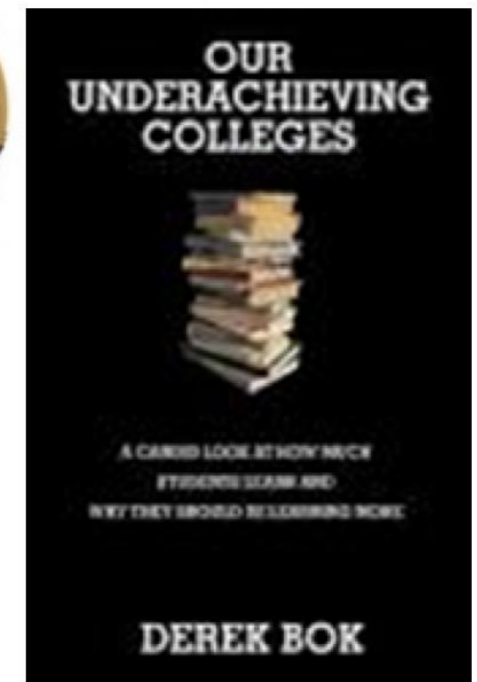




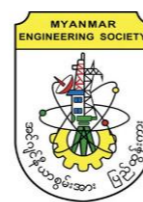


# Purposes of Undergraduate Education

1. Learning to communicate
2. Learning to think
3. Building character
4. Preparation for citizenship
5. Living with diversity
6. Preparing for a global society
7. Acquiring broader interests
8. Preparing for a career



*Our Underachieving Colleges*  
By Derek Bok  
President of Harvard University  
(1971-1991)







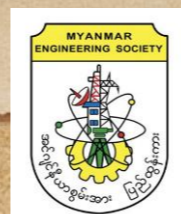
# Levels of Education



**Education for Life**

**Education for Living**

**Education for Career**







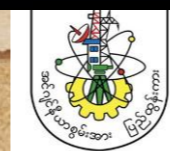
**Formal Curricula**

**Evolving with emerging technologies in 4<sup>th</sup> Industrial Revolution, smart services and globalization**

**Co-Curricula**

**Powered by ethics and morality, character building, high order thinking, multiple intelligences, mind and hands, soft skill competencies, lifelong learning to face new challenges**

**Hidden Curricula**







**THANK YOU *for* Kind Attention**

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