UGM A.I. CENTER OF EXCELLENCE

UGM AI CUBIC
COLLABORATIVE • UNIVERSAL • BREAKTHROUGH
INNOVATIVE • COMPETITIVE

Artificial Intelligence for Academic-Industry Alliance Innovation

PREFACE

Prof. Ir. Selo, S.T., M.T., M.Sc., Ph.D., IPU.
Dean, Faculty of Engineering UGM

A.I. implementation has a large potential to change our society. The establishment of "UGM A.I. CUBIC" as UGM A.I. Center of Excellence becomes the answers to questions **such** as what kind of a society should we aim for, and what technologies will become necessary to achieve this. Certainly, close collaboration between researchers in the academic and industry is indispensable.

Ir. Hanung Adi Nugroho, S.T., M.E., Ph.D., IPM.
Head, Dept. of Electrical Eng. and Information Tech.

UGM A.I. Center of Excellence (with a slogan, "UGM A.I. CUBIC") strives to contribute to the improvement towards the society by disseminating the research and implementing them, and utilizing the feedback which is gathered to make further advances in future research. For accomplishing that, this research center needs to work on projects in collaboration with industries and other partners.

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Co Founder and CEO at Sehati Telectg Group.

Romi Satria Wahono
Founder and CEO at PT Brainmatics,
IlmuKomputer.com, and Intelligent Systems
Research Center

A.I.: WHY NOW?

ARTIFICIAL INTELLIGENCE: BY THE NUMBERS

Enterprises are turning to artificial intelligence (AI) to help analyze data and use it to make effective business decisions. A new survey from Narrative Science reveals how enterprise CEOs, knowledge workers, data scientists and analysts perceive and use AI and Big Data in their enterprises. Some notable findings are highlighted here.

31%
3%
25%
28.5%
1.5%
4%
7%
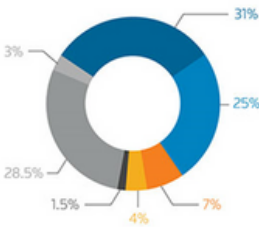
Enterprise leaders define AI as technology that:

- Thinks and acts like humans
- Can learn to do things better over time
- Can understand language
- Can answer questions
- Passes the Turing test
- All of the above
- Other

80% OF ENTERPRISE EXECUTIVES SAY AI MAKES WORKERS MORE PRODUCTIVE AND CREATES JOBS
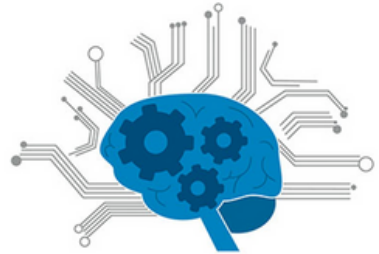
29%

The highest percentage (29%) of respondents named **PREDICTIVE ANALYTICS** as the top priority they think their organizations could address with AI-powered solutions.

57.9% OF BUSINESSES
WITH BIG DATA TECH HAVE
AI SOLUTIONS DEPLOYED

53%
ON AVERAGE, ORGANIZATIONS FEEL THEY ARE GETTING 53% OF THE POTENTIAL INSIGHTS FROM THEIR AVAILABLE DATA

EXECUTIVES ACKNOWLEDGE
DATA ANALYTICS TECHNOLOGIES ARE MORE EFFECTIVE AT PRODUCING PROBLEM-SOLVING INFORMATION WHEN PAIRED WITH AI.

THE PRIMARY REASON ENTERPRISES CURRENTLY USE AI IS FOR:

48.5%
Automated communications that give business audiences data they can use to make effective business decisions

13.6%
Automated communications that give consumer audiences data they can use to make effective decisions

6.1%
Automation that eliminates manual and repetitive tasks

4.6%
Monitoring and alerts about the health of the business. Automated data-driven reporting
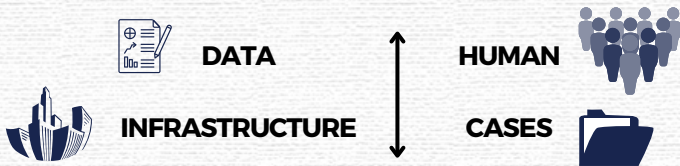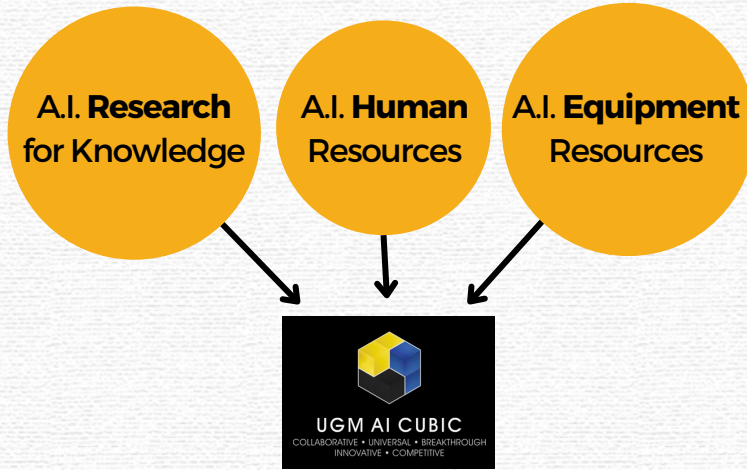
A.I. is Imminent!

UNIVERSITAS GADJAH MADA

**Slogan UGM A.I. CUBIC
is a pun of "UGM triple A.I."**
which stands for
"**A**rtificial **I**ntelligence for **A**cademic-**I**ndustry **A**lliance **I**nnovation"

A.I. **Research** for Knowledge

A.I. **Human** Resources

A.I. **Equipment** Resources

UGM AI CUBIC
COLLABORATIVE • UNIVERSAL • BREAKTHROUGH
INNOVATIVE • COMPETITIVE

DATA

HUMAN

INFRASTRUCTURE

CASES

INDUSTRY

BUMN

Corporate

Industrial Collaborators

Government

Startup

A.I. IS AN ENDLESS TRIP ...

training

- Give A.I.–related training for students, academics, industry, and governments
- Prepare A.I.–ready human resources

research

- Conduct the researches on A.I. for solving real world problems
- Strengthen the knowledge on A.I.

industrial partnership

- Collaboration with industry for solving A.I.–related strategic enterprise problem
- Assist the industry for evolving towards INDUSTRY 4.0

A.I. in Biomedical & Health

A.I. is transforming the world of medicine. It helps doctors make faster, more accurate diagnoses. It predicts the risk of a disease in time to prevent it. It helps researchers understand how genetic variations lead to disease. It enhances doctors' ability to analyze medical images.
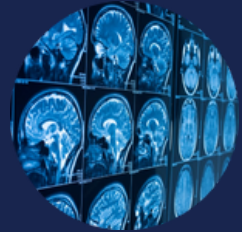
A.I. in Internet & Security

We are focusing on A.I. implementation on image and text processing for intelligent online content filtering system with main purpose of protecting youth and infants from pornographic content and fraud.

A.I. in Intelligent Transportation Systems

The main application of A.I. within the automotive domain is that of advanced computer vision and perception. Visual tasks, including, but not limited to lane detection, pedestrian detection, road signs recognition and blind-spot monitoring are handled more effectively with A.I.

A.I. in E-Commerce & Enterprise

A.I. adoption in the enterprise is expected over the next few years, initially to improve existing processes and then reinvent them. Applications that could benefit from A.I. include smarter appliances in IoT, as well as automation across operational technology, information technology, customer support, and enterprise workflows.

OUR
ENVISION

A.I. in Energy & Renewable Energy

Energy and renewable energy research (wind, solar, hydro, nuclear) have greatly benefited from the power of A.I. and data science over the past years. The applications are ranged from Smart Grid, Predictive Maintenance, to Energy Source Exploration. We are focusing on lowering costs, making better predictions, and increasing the rate of energy efficiency.

A.I. in Telecommunication

There is vast amount of A.I. implementation on tele-communication, such as information security, integrated voice support, multilingual, information accuracy, and auto-update knowledge base.

A.I. in Social Networks

A.I. technology can be utilized to profile your prospective customers, by analyzing their behavior on social media and digital platforms. Artificial intelligence can determine what their habits are, and what motivates them to spend money. These types of analyses are essential in personalized campaigns.

A.I. in Finance & Banking

A.I. platforms can provide a solution for automating the gathering and analysis of vast amounts of data. It offers a great opportunity for financial institutions to offer desirable business improvements like bespoke customer service, automated financial performance reports focused directly to individuals, and simple-to-understand trading strategy suggestions.
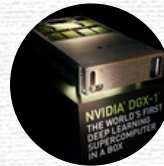
OUR
A.I. RESOURCES

UGM A.I. Group is enforced by cutting-edge devices and equipment for conducting A.I. researches and projects in many applications.

NVIDIA DGX-1
One of the most powerful GPU for A.I. and Deep Learning research.

NVIDIA GTX 1080 /Ti/TITAN XP
One of the powerful GPU for A.I. and Deep Learning research.

JETSON TK1
The NVIDIA Jetson TK1 developer kit gives you everything you need to unlock the power of the GPU for embedded systems applications.

JETSON TX1/TX2
This AI supercomputer features NVIDIA Maxwell™ architecture, 256 NVIDIA CUDA® cores, 64-bit CPUs, and a power-efficient design.
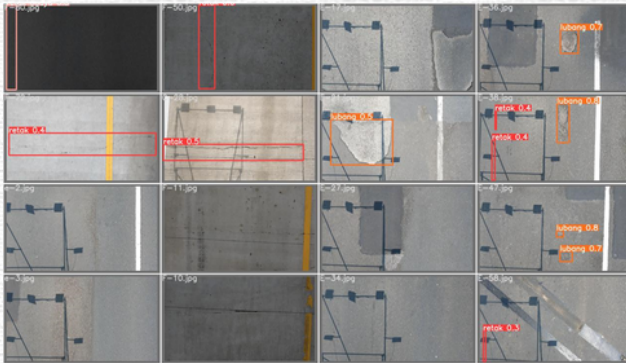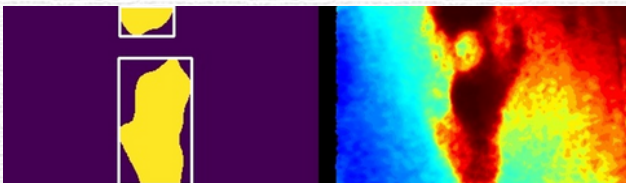
SHOWCASE: RECENT RESEARCH

Road Monitoring System

This project is joint research with BPJT (Badan Pengatur Jalan Tol) for the road monitoring system. The task is to predict the crack and pothole on the highway road segment using multiple image sensors, i.e., depth and color image sensors. The system is able to record the dimension and severity of each crack or pothole along with its location (latitude and longitude). Thus, we are able to mitigate the damage before it becomes severe. The web-based information system was also developed to estimate the total maintenance budget and the statistics of damage types for each segment of the road.

Badan Pengatur Jalan Tol
Kementerian Pekerjaan Umum

Automated Visual Inspection for Camshaft Defect Detection

at PT Musashi Auto Parts Indonesia

PT Musashi Auto Parts Indonesia asked UGM Team for helping them on visual inspection for Camshaft Defect Detection. The AI based defect detection system has 10 classes of defects on Camshaft, using Embedded System Inference, NVIDIA-based training server, and ARM Robotic deployment.
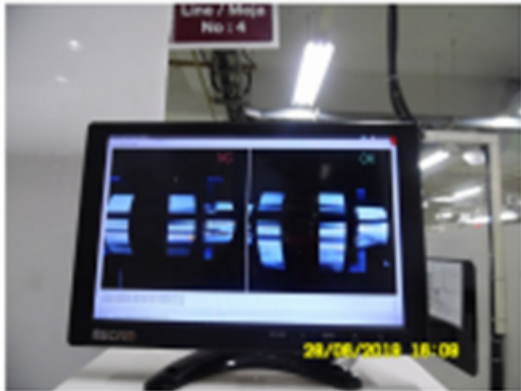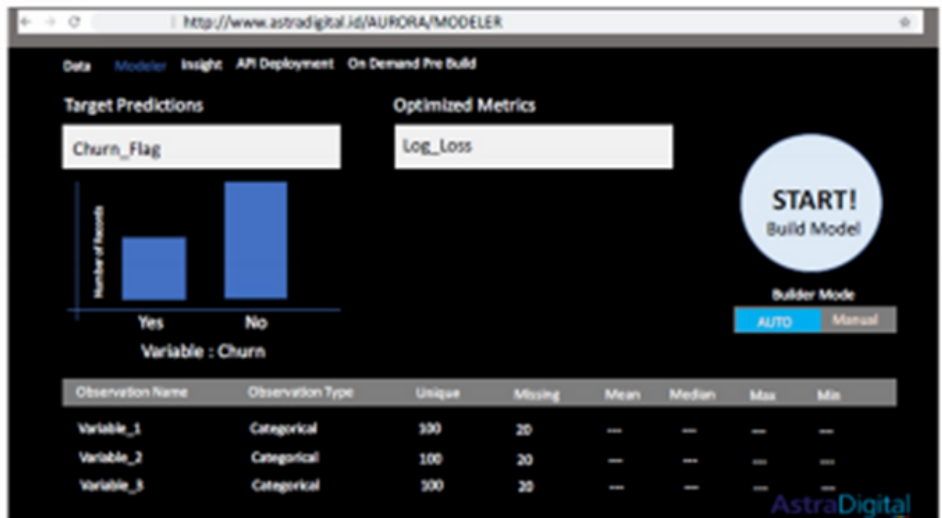
SHOWCASE:
RECENT RESEARCH

Astra Digital
Automated Model Builder

This project is a collaboration with Astra Digital. We are developing an automated machine learning model builder that can be used to train and analyze data with less technical person required to run the operations.

Surveillance System (International Internship)

This internship program is a collaboration with Toyohashi University of Technology, a national engineering university located in Toyohashi, Aichi, Japan. The intern, **Ryosuke Yoda** was developing a surveillance system which can track a certain person using CCTV footage for 5 months in our laboratory.
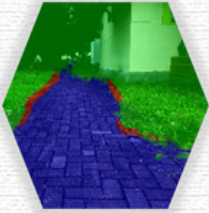
SHOWCASE: PAST RESEARCH

road boundary detection and tracking using deep learning

- Give A.I.–related training for students, academics, industry, and governments
- Prepare A.I.–ready human resources

road-scene segmentation with deep learning on embedded system

Road-scene segmentation is a part of general image segmentation problems which tries to characterize the road-scene. It has a huge range of applications, e.g. Intelligent Vehicle and Advanced Driver Assistance System (ADAS). We have successfully built the RCC-Net on a low-cost embedded system, NVIDIA Jetson TK1, opening the possibilities for in-car deployment.
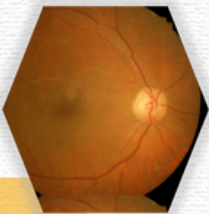
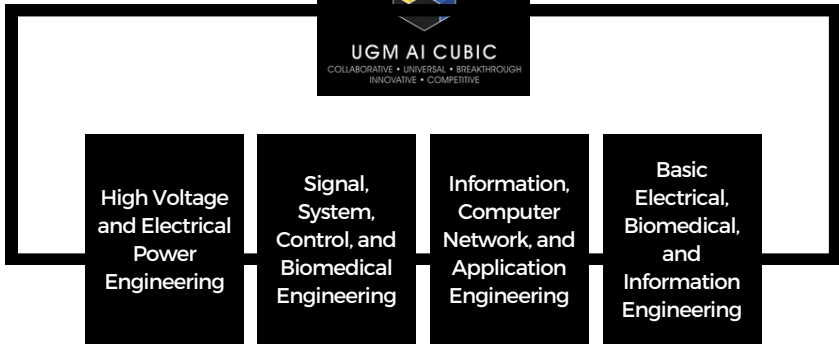### deep learning for diabetic retinopathy assessment

Diabetic Retinopathy (DR) is a disease which affect the vision ability. The observation by an ophthalmologist usually conducted by analyzing the retinal images of the patient which are marked by some DR features. Here, a deep learning-based low-cost embedded system is established to assist the doctor for grading the severity of the DR from the retinal images.

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DTETI
DEPARTEMEN TEKNIK ELEKTRO DAN TEKNOLOGI INFORMASI
FAKULTAS TEKNIK UNIVERSITAS GADJAH MADA

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| High Voltage and Electrical Power Engineering | Signal, System, Control, and Biomedical Engineering | Information, Computer Network, and Application Engineering | Basic Electrical, Biomedical, and Information Engineering |

AI: Data-based learning

Big Data: Capture, storage, analysis of data

IOT: Data Collection through IoT

EV ELECTRIC VEHICLE

DRONE

power electronics

BIOMEDICAL ENGINEERING

PARTNERSHIP

Research and development partners
from universities, government institutions, and companies

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STRATEGIC PARTNERSHIP

Smart City
Group

DTAP, Smart Building,
Smart Customer System

Smart Transportation
Group

Iot, Mobility Group

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Smart Health
Group

DTETI, FKKMK, RS Sardjito

Smart Grid
Group

Power Electronics, Electric Vehicle

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A.I. CUBIC ROADMAP

2019/1

- A.I. CUBIC Launching
- Install NVIDIA DGX
- Establish subdivision of A.I. CUBIC, e.g. Commerce, Health, Agriculture, Big Data, Smart City

2019/2

- A.I. CUBIC joint work with overseas universities
- A.I. Exhibition Week
- A.I. CUBIC becomes A.I. Learning Center for both academic and industry

2020

- A.I. CUBIC creates 1000 talents with A.I. -ready capability
- A.I. CUBIC becomes main mentor for A.I.-related industry

2021

A.I. CUBIC becomes main partner of industrial A.I. project in Indonesia

2022

A.I. CUBIC becomes **A.I. Leader** in Indonesia

A.I. CUBIC TEAM FORCES

Teguh Bharata Adji, S.T., M.T., M.Eng., Ph.D.
Social Media Tech., Recommender System, Chatbot, ERP

Ir. Noor Akhmad Setiawan, S.T., M.T., Ph.D., IPM.
Deep Learning, Brain Machine Interaction, Machine Learning

Ir. Hanung Adi Nugroho, S.T., M.E., Ph.D., IPM.
Biomedical Engineering, Biomedical Imaging

Dr.Eng. Igi Ardiyanto, S.T., M.Eng.
Deep Learning, Robotics, Computer Vision, Embedded System

Dr. Sunu Wibirama
Eye Tracking, UI/UX

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Artificial Intelligence

Ir. Lukito Edi Nugroho, M.Sc., Ph.D.
Distributed & Internet Computing, Smart City

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Dr. Ir. Risanuri Hidayat, M.Sc., IPM.
Signal Processing, Communication System

100+ INTERNATIONAL PUBLICATIONS ON A.I.

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