

*...intelligent computing to knowledge creation...*

# Knowledge Engineering Research Group

## Politeknik Elektronika Negeri Surabaya



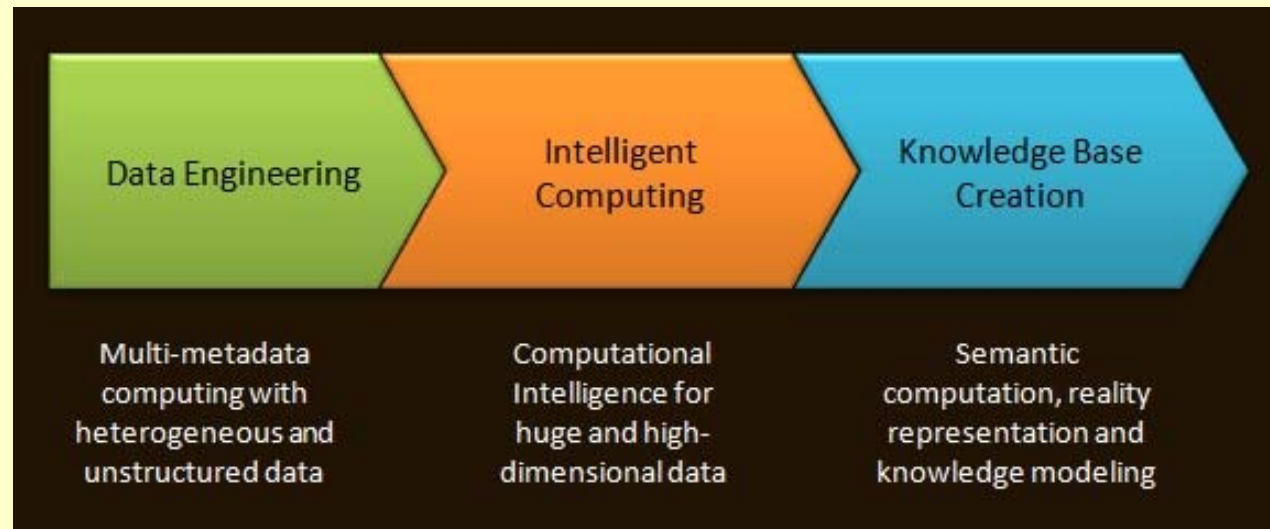
- Knowledge Engineering Research Group

Research Group, started from 2012, that works for integrating knowledge into computer systems in order to solve complex problems normally requiring a high level of human expertise.

- Vision

*"...beyond Intelligent Computing towards Knowledge Creation..."*

- Mission



# People



Tita Karlita  
(Group  
Leader)



Muarifin  
(Tech. Support)



Ali Ridho  
Barakbah  
(Assc.Prof.)



Entin  
Martiana  
(Research  
Assistant)



Tri Hadiah  
(Tech. Support)



Tri Harsono  
(Assc.Prof.)



Nana  
Ramadijanti  
(Research  
Assistant)



Dias Agata  
(Tech. Support)



Nur Rosyid  
Mubtadai  
(Research  
Assistant)

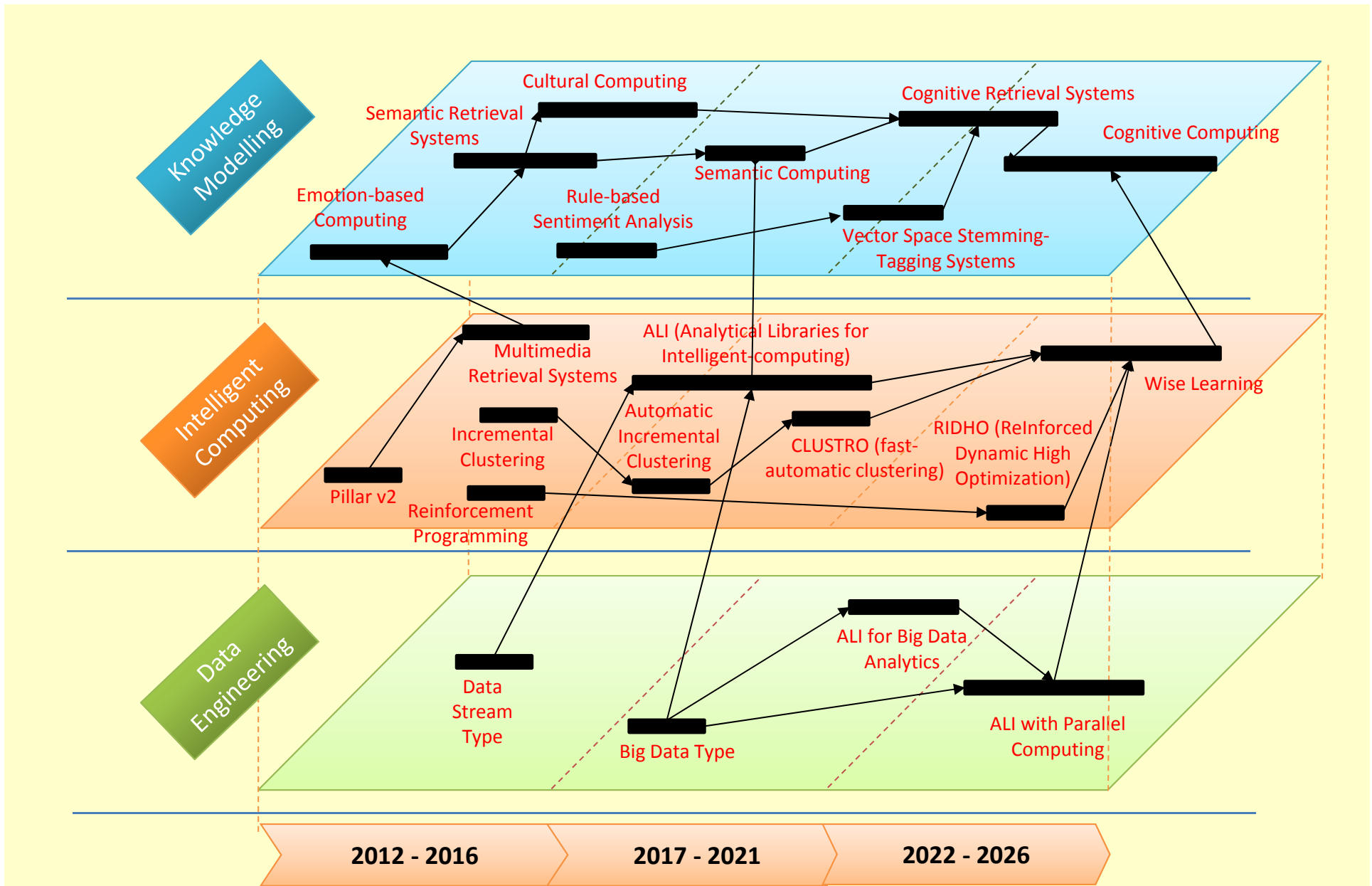


Ira  
Prasetyaningrurn  
(Research  
Assistant)



Saniyatul  
Mawaddah  
(Tech. Support)





# Research Areas

- Data Analytics
- Computational Linguistics
- Intelligent Medical Computing
- Disaster Risk Modelling
- Big Data Engineering & Parallel Computing
- Intelligent System
- Neural Computing for Computer Vision



# Collaborative Partners



Faculty of Data Science



Politeknik Elektronika  
Negeri Surabaya

Knowledge Engineering  
(knoWing) Research Group



# Research Innovations

- **K-Means optimization:** Optimized K-Means, MDC, Hierarchical K-Means, Pillar v1, Pillar v2, CLUSTRO
- **Automatic clustering:** Valley Tracing
- Shape Independent Clustering
- **Incremental clustering:** Pursuit Reinforcement Competitive Learning (PRCL)
- **Distance metric for shape & structure features in image retrieval:** Semantic Distance
- **Cluster analysis:** Centroid Proximity Index (CPI)
- **Objective-based Reinforcement Learning:** Reinforcement Programming
- **Grid-based earthquake density measurement algorithm:** Density measurement algorithm
- **Vector space-based programming for intelligent computing:** Analytical Libraries for Intelligent-computing (ALI)
- Rule-based Semantic Analysis
- Knowledge-based Chatbot System



# Research Projects & Works

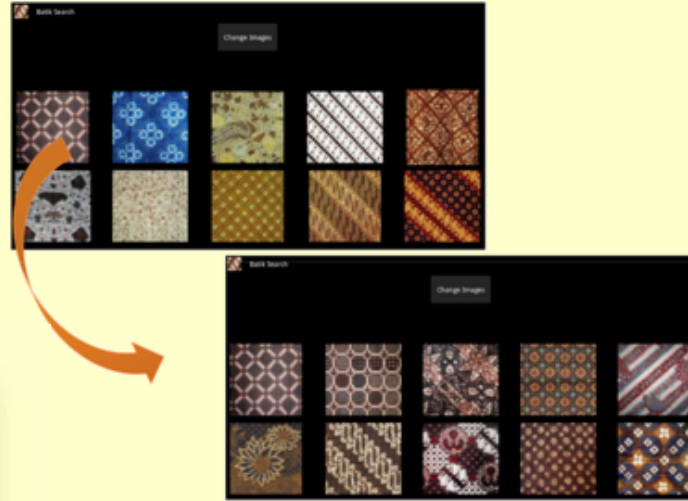
- Hierarchical K-Means → open source, used in Matlab communities
- Analytical Libraries for Intelligent-computing → Open library
- Cultural computing → Collaborative work with Keio univ.
- Deforestation measurement → Collaborative research with Keio University and Chulalongkorn University to measure 4 national parks in Thailand
- Iris computing → Research project funded by Indonesian government, collaborative work with “Mugi Barokah” Iridology clinic for Iridology, Sclerology and Eyelogy Computation
- Earthquake Spatial Analysis → Research project funded by Indonesian government and collaborative work with Keio Univ. and Musashino univ.
- Tornado Prediction → Research project funded by Indonesian government and collaborative work with BMKG
- Sentiment Analysis for public services → used in Surabaya local government
- Chatbot system → used in PDAM
- Tourism: Thoughtful Indonesia → visual based tourism place recognition
- Chronic Wound analysis → wound treatments
- Covid-19 detection and classification → Radiology images analysys



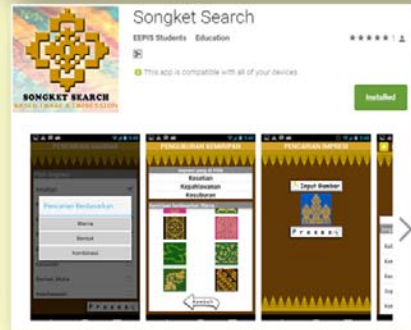


# Cultural Computing

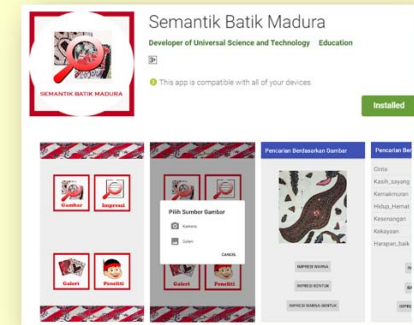
## Batik Image Search System



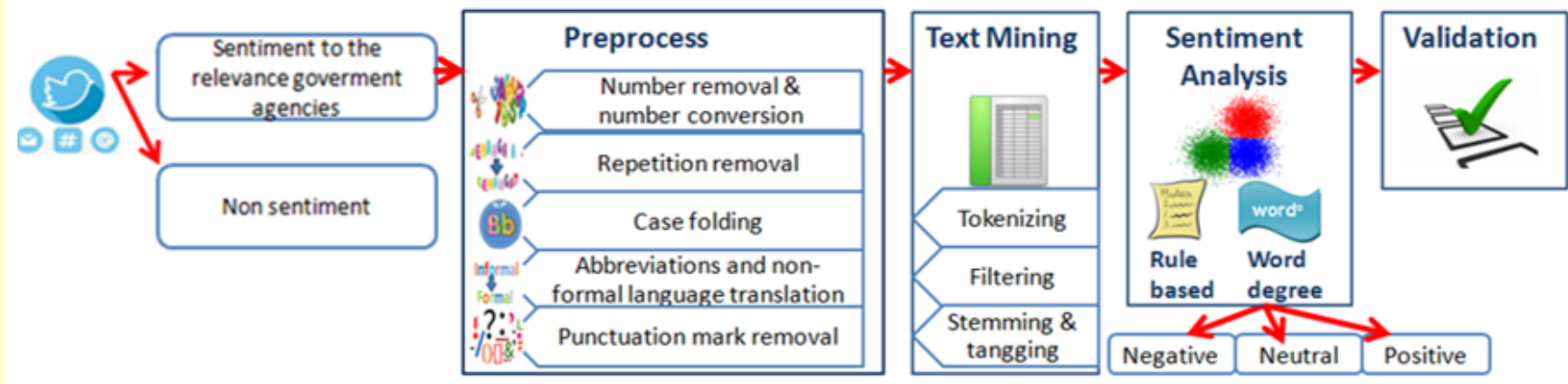
## Semantic Songket Image Search System



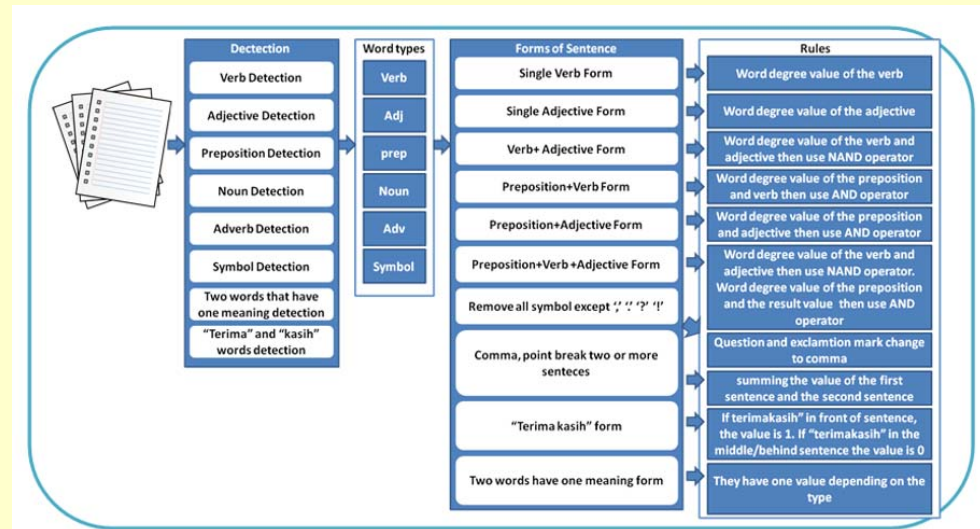
## Semantic Madurese Batik Image Search System



# Computational Linguistics



## Rule-based Sentiment Degree Measurement of Opinion Mining of Community Participatory in Government of Surabaya



### Sentiment Surabaya Dashboard

OUR ANALYTICS

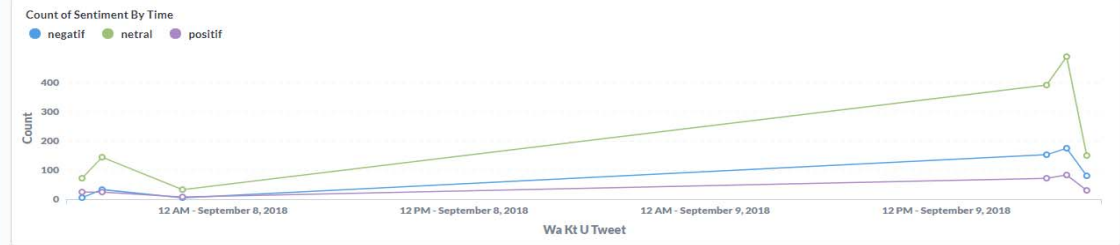
Relative Date Today SKPD



Tweets

Wa Kt U Tweet: Day	Tweet	Score	Sentiment	Sk Pd
September 9, 2018	follow up area surabaya expo banyuwangi 14 15 sept jembe https t.co tsbv2npgg	0	netral	TIDAK TERDEFINISI
September 9, 2018	available booking female escort, jogjaexclude room wajib dp27lh 160cm 45kg bra 34b kulit sawo matangcontact https t.co m12ok4njs	0	netral	TIDAK TERDEFINISI
September 9, 2018	kulinerlendir lendirand bispaksurabaya openbo openbosurabaya bispaksby bisyarsurabaya bisyarsby https t.co mp1r6vcuz7	0	netral	TIDAK TERDEFINISI
September 9, 2018	info booking klik surabaya zone lendirand https t.co grko5fupmq	0	netral	TIDAK TERDEFINISI
September 9, 2018	rt salam dari lombok utara dari sabat2 banser kota surabaya, berhenti menghujat, berhenti memaki apa lagi memfitnah, ayo	0	netral	TIDAK TERDEFINISI

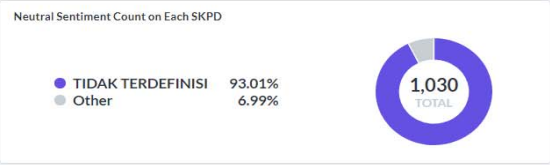
Rows 1-5 of 1628



#### Data Seluruh SKPD

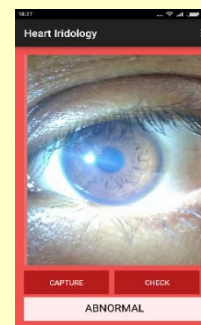
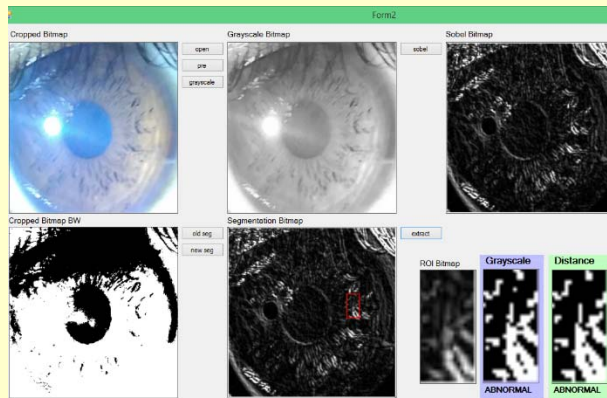
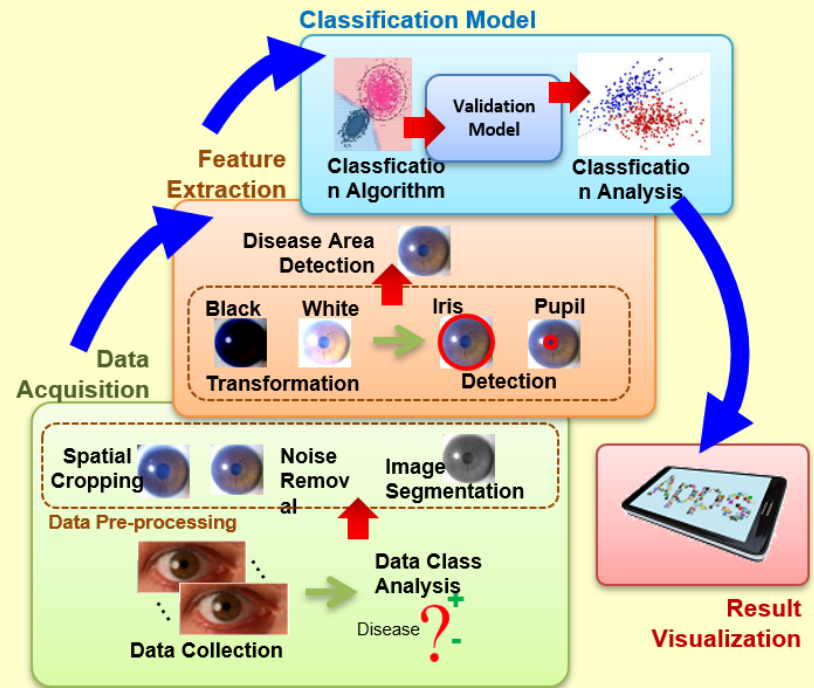
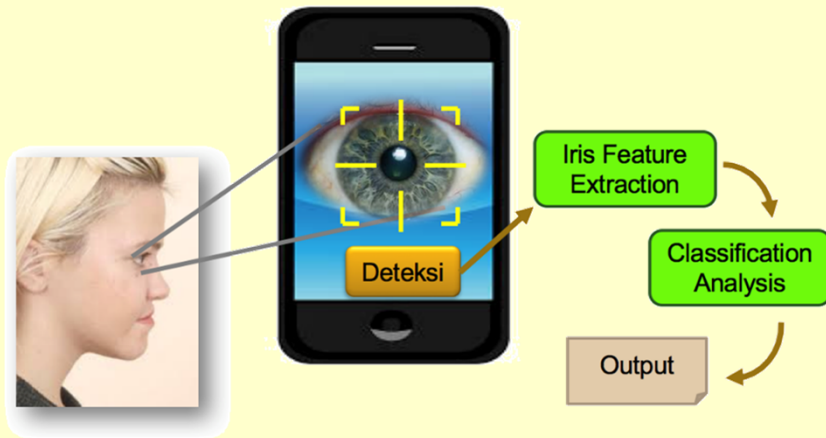
Jumlah Sentimen Per SKPD

Sk Pd	negatif	netral	positif
Dinas Kebersihan dan Pertamanan	4	9	4
Dinas Kebudayaan dan Pariwisata	-	5	-
Dinas Kesehatan	4	-	1
Dinas Keterangkerjaan	-	1	-
Dinas PU Bina Marga dan Pemotusan	172	9	14
Dinas Perhubungan	15	11	17
PDAM	-	4	5
PLN	4	4	4
Satpol PP	19	18	8
TIDAK TERDEFINISI	192	958	133
Tri Rismaharini	-	11	2



# Medical Computing: Iridology

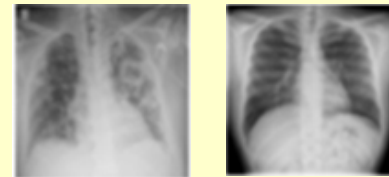
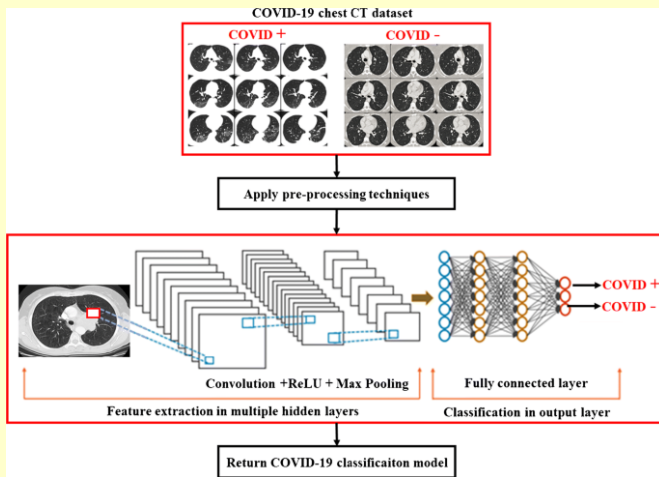
Collaboration with Medical Healthcare Service “Mugi Barokah” in Surabaya



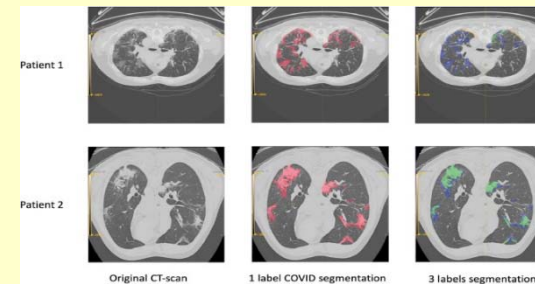
- Heart
- Cholesterol
- Liver
- Diabetes



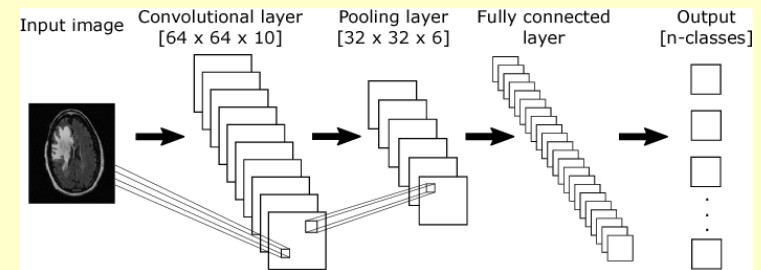
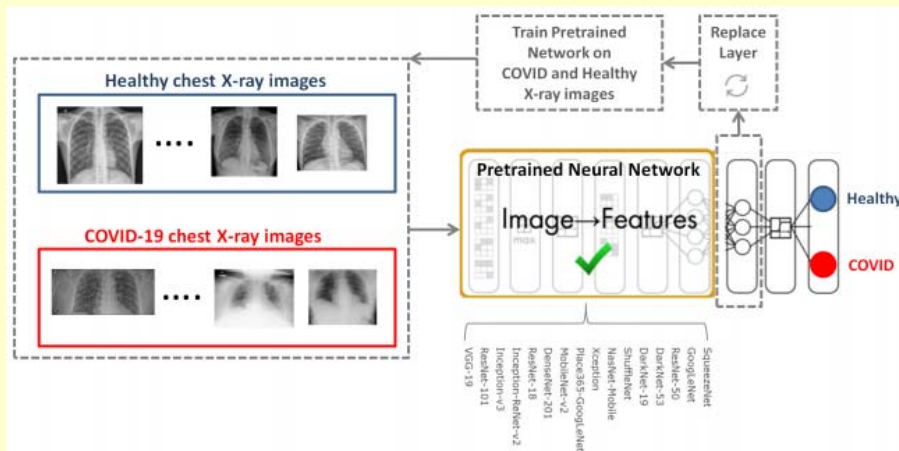
# Intelligent Medical Computing: Radiology image-based analysis for Covid-19 detection



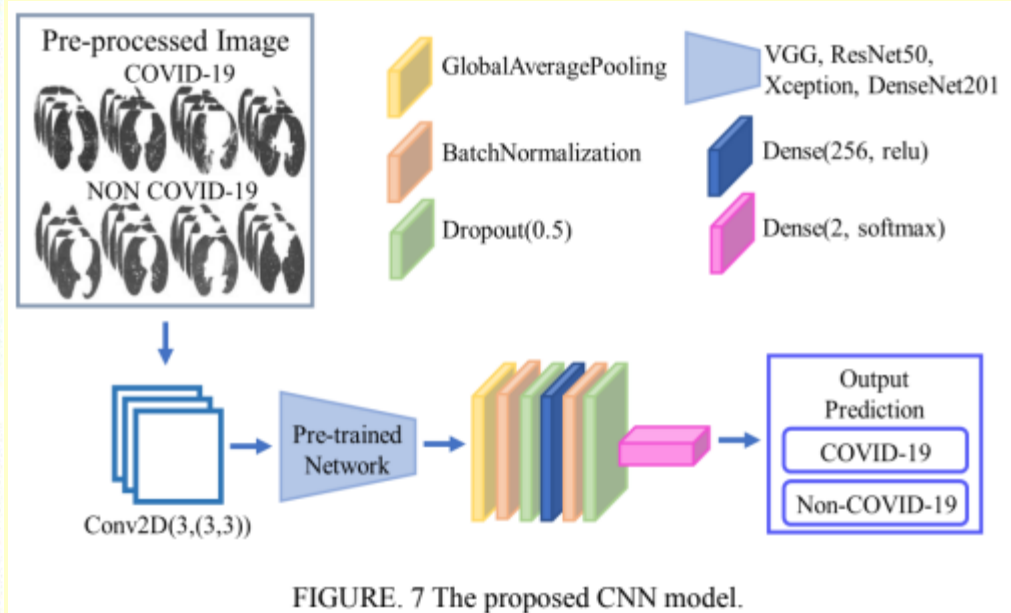
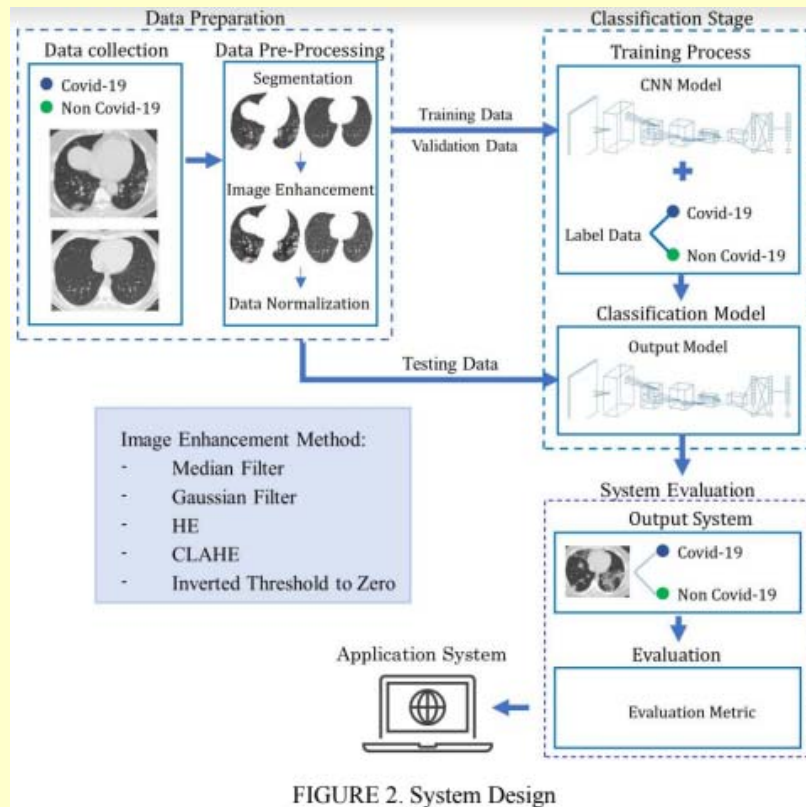
COVID-19 VS non COVID-19



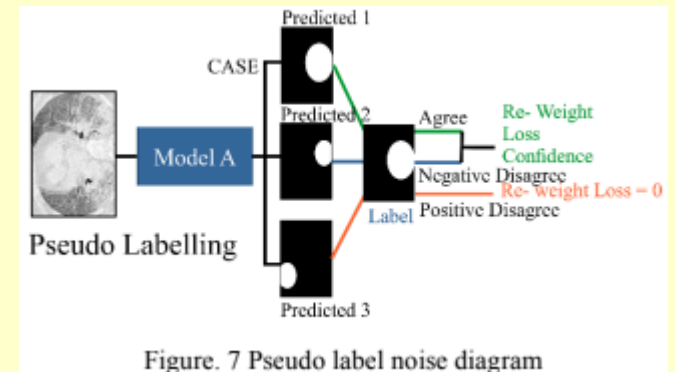
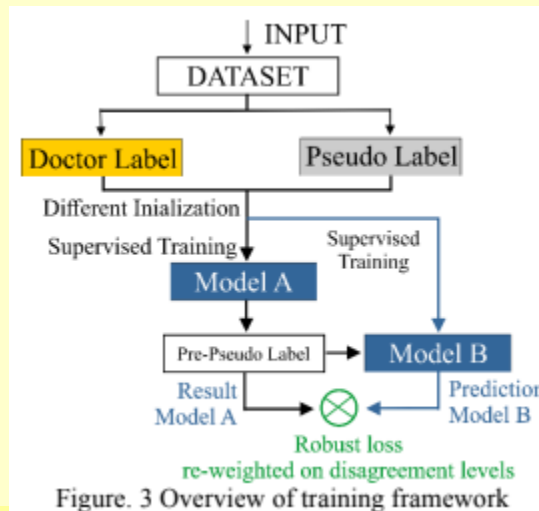
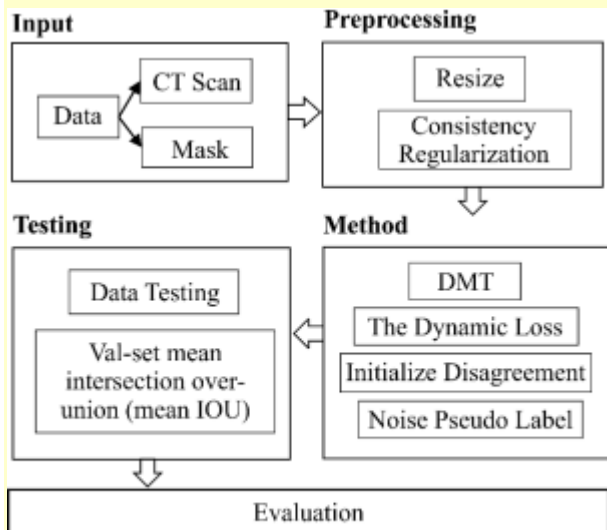
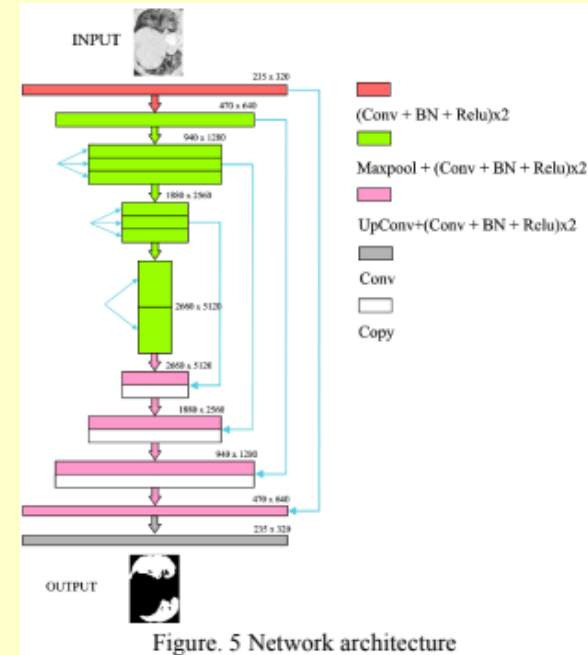
COVID-19 Segmentation



# Effect of Image Pre-processing Method on Convolutional Neural Network Classification of Covid-19 CT Scan Images



# Semi-Supervised Segmentation of COVID-19 Infection on CT-Scan Lung Using Dynamic Mutual Training



# Smart Odontogram: Rekam Medis Elektronik dan Real Time Diagnosis Gigi Pasien

## Contoh Pengisian Odontogram Dewasa

KOP SATKER

FORMULIR PEMERIKSAAN ODONTOGRAM (DEWASA)

NAMA LENGKAP : **JOKO SUSILO** JENIS KELAMIN : L / P-  
 NIK/No.KTP : **3173021202670003** TTL : **BANTUL 12 Februari 1967**

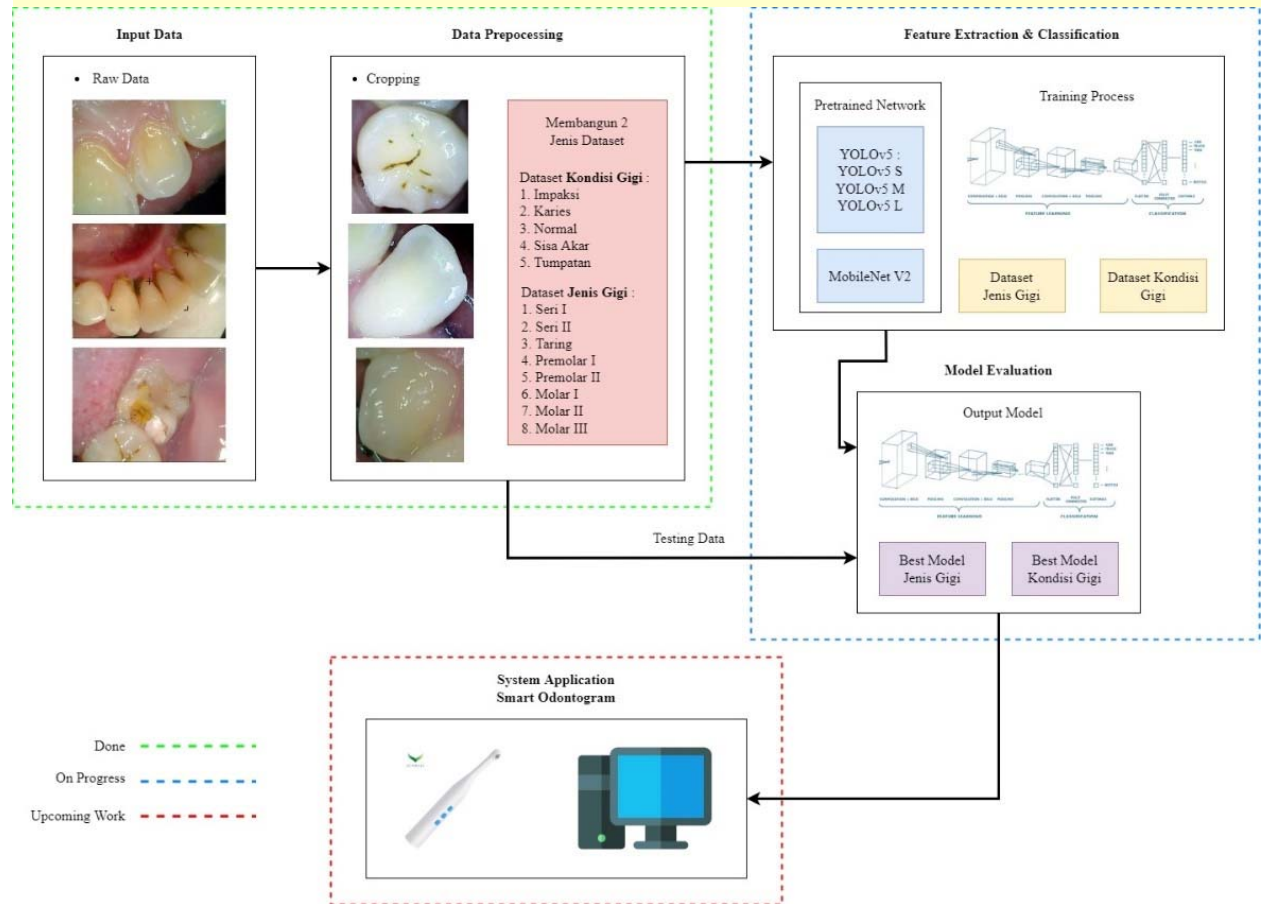
11	M car	sou	21
12	ano	cfr '1/3 insisal	22
13	sou	sou	23
14	sou	O oof	24
15	mis	mis	25
16	O amf	poc-rct	26
17	mis	rxr	27
18	non	non	28

48	une	une	38
47	O car - nvt	O fis	37
46	O cof - rct	poc	36
45	pob	sou	35
44	miss-pon-pob	miss-prd-acr	34
43	pob	miss-prd-acr	33
42	sou	sou	32
41	sou	sou	31

Occlusi : Normal Bite / ~~Cross-Bite~~ / ~~Sleep-Bite~~  
 Torus Palatinus : ~~Tidak Ada~~ / ~~Keeth~~ / ~~Sedang~~ / ~~Besar~~ / ~~Multiple~~  
 Torus Mandibularis : ~~Tidak ada~~ / ~~sisi-kiri~~ / ~~sisi-kanan~~ / ~~kedua-sisi~~  
 Palatum : ~~Dalem~~ / ~~Sedang~~ / ~~Rendah~~  
 Diastema : ~~Tidak Ada~~ / ~~Ada~~ (dijelaskan dimana dan berapa lebarnya) .....  
 Gigi Anomali : ~~Tidak-Ada~~ / ~~Ada~~ (dijelaskan gigi yang mana, dan bentuknya) ..~~RL~~ ~~RS~~ ~~SD~~ ~~SD~~ .....  
 Lain-lain : (hal-hal yang tidak tercakup diatas) .....  
 D : ..... M : ..... F : .....

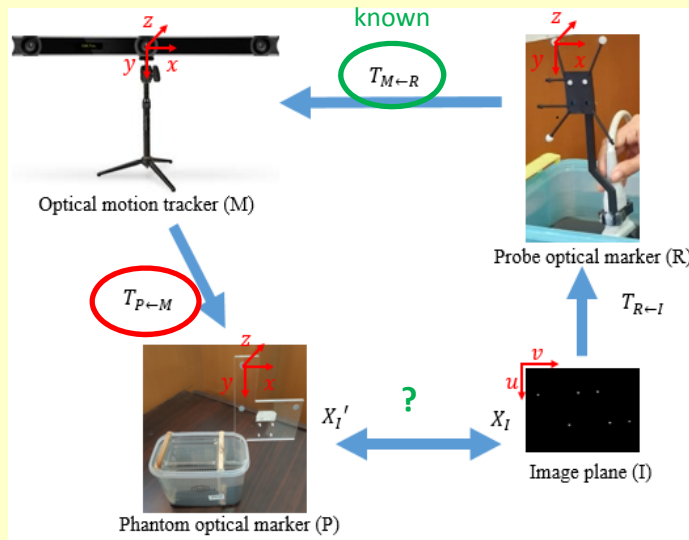
Jumlah photo yang diambil ..... (digital/intraoral)\*  
 Jumlah rontgen photo yang diambil ..... (Dental PA/OPG/Ceph)\*

DIPERIKSA OLEH: TANGGAL PEMERIKSAAN TANDA TANGAN PEMERIKSA:  
 Drg. **INDRA** ..... 29 / 08 / 2014 ..... *Indra*

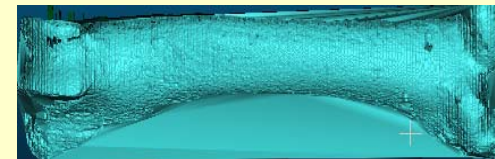




# Freehand 3D ultrasound imaging system

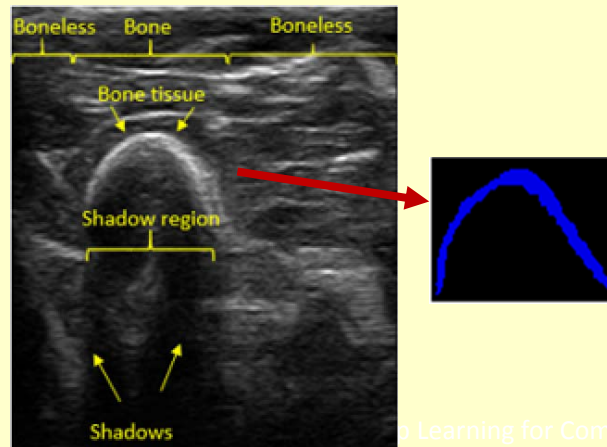


Freehand



3D bone model

## Bone detection and segmentation



Learning for Computer Vision



# Linear-Mechanical 3D ultrasound imaging system

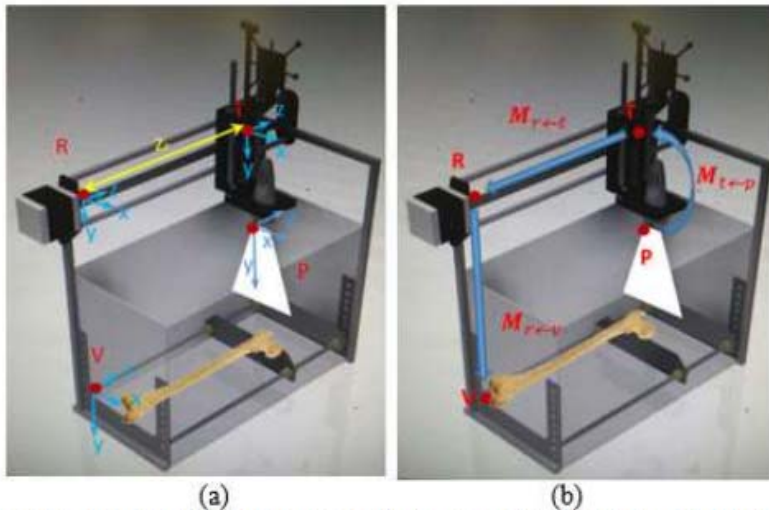


Figure 6. (a) Identification of the device coordinate systems. P, T, R, and V are the coordinate system of the 2D ultrasound image plane, the probe holder, the origin of the sliding track, and the volume space. (b) Illustration of transformation between P, T, R, and V.

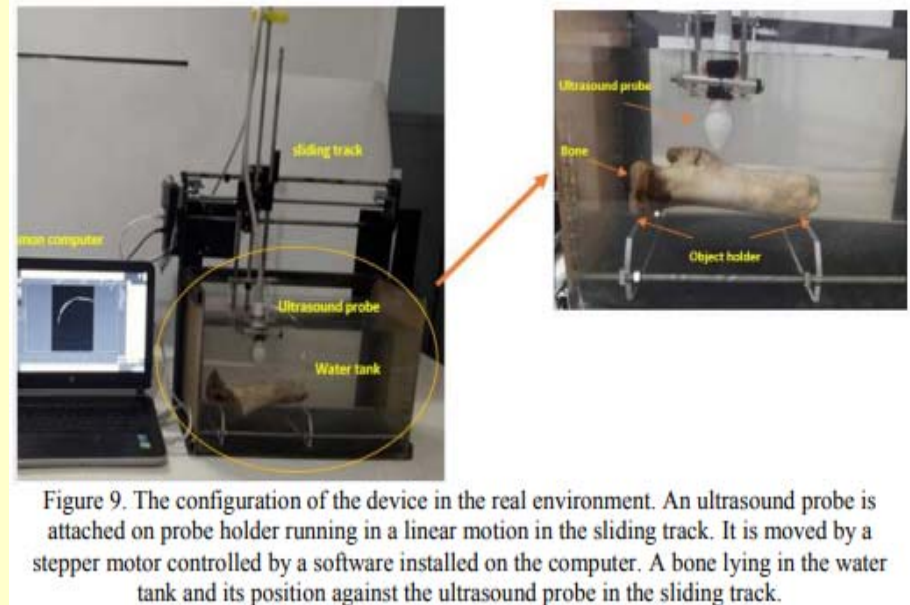


Figure 9. The configuration of the device in the real environment. An ultrasound probe is attached on probe holder running in a linear motion in the sliding track. It is moved by a stepper motor controlled by a software installed on the computer. A bone lying in the water tank and its position against the ultrasound probe in the sliding track.

<http://www.ijeei.org/docs-1493143405d47f8fc05114.pdf>

# Vehicle Classification System in GTO

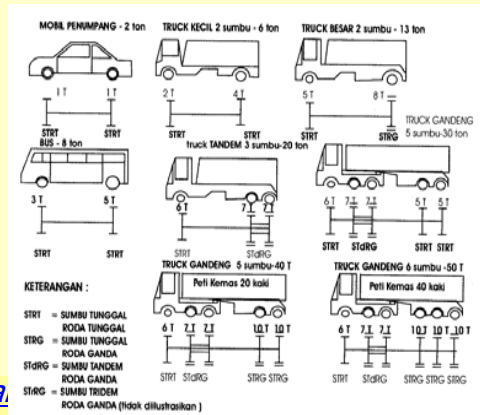
## Infrared System



## Automatic vehicle classification



## Treadle & Overhang System



GOLONGAN JENIS KENDARAAN BERMOTOR PADA JALAN TOL YANG SUDAH BEROPERASI

Berdasarkan Kepmen PU No 370/KPTS/M/2007

Golongan	Jenis Kendaraan
Golongan I	Sedan, Jip, Pick Up/Truk Kecil, dan Bus
Golongan II	Truk dengan 2 (dua) gandar
Golongan III	Truk dengan 3 (tiga) gandar
Golongan IV	Truk dengan 4 (empat) gandar
Golongan V	Truk dengan 5 (lima) gandar
Golongan VI	Kendaraan bermotor roda 2 (dua)

Source : <https://www.gridoto.com/read/221270564/bia>



Politeknik Elektronika Negeri Surabaya

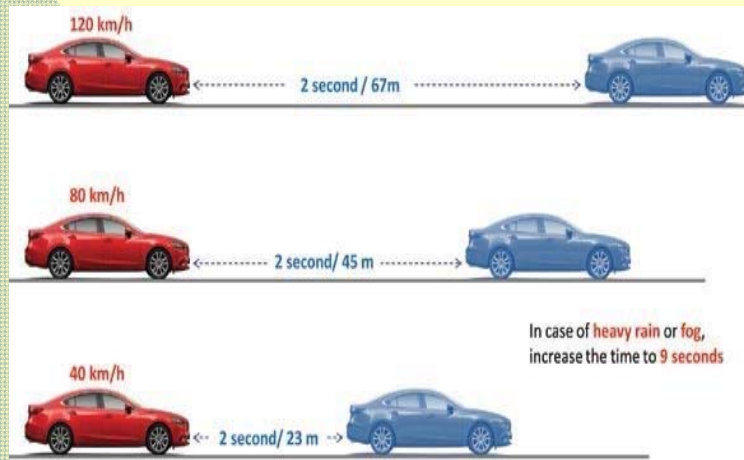
Knowledge Engineering (knoWing) Research Group



# Vehicle's Safe Distance Detection System



Data acquisition



# Identification of the Effect of Different Feature Samples on Handwritten Japanese Character Recognition



Fig. 2. Row wise, above is ETL-8, and below are ETL-9 samples (Originally extracted)

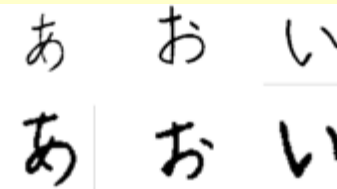


Fig. 3. Row wise, above is ETL-8, and below are ETL-9 samples after reverse binarization



Fig. 4. Left photo hiragana written using pencil, right photo hiragana written using ballpoint

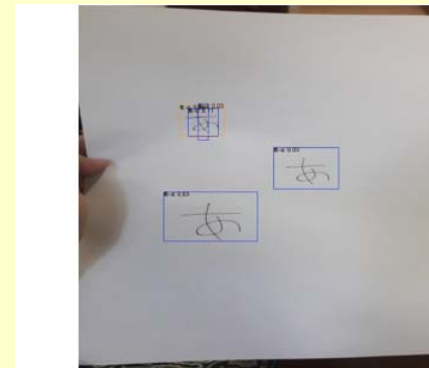


Fig. 12. Camera distance to object (around 28 centimetres)

Yolov4



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Negeri Surabaya

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# Crowd Counting in Public Places Using Multiscale Convolutional Neural Network

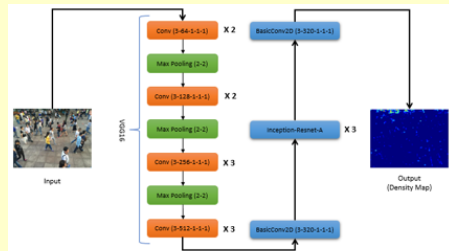


Fig. 4. Multi-Scale CNN Architecture. The parameters for the convolution layer is denoted as Conv(kernel\_size, output\_channel, dilation\_rate, stride, padding). While the parameters for the BasicConv2D block is denoted as BasicConv2D(kernel\_size, output\_channel, dilation\_rate, stride, padding)

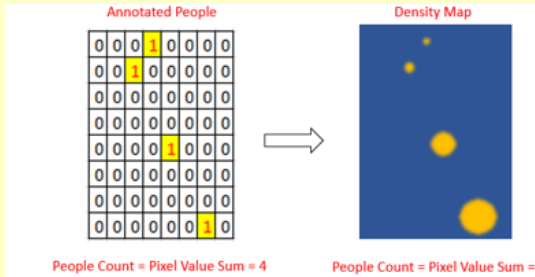


Fig. 3. Illustration of ground-truth generation

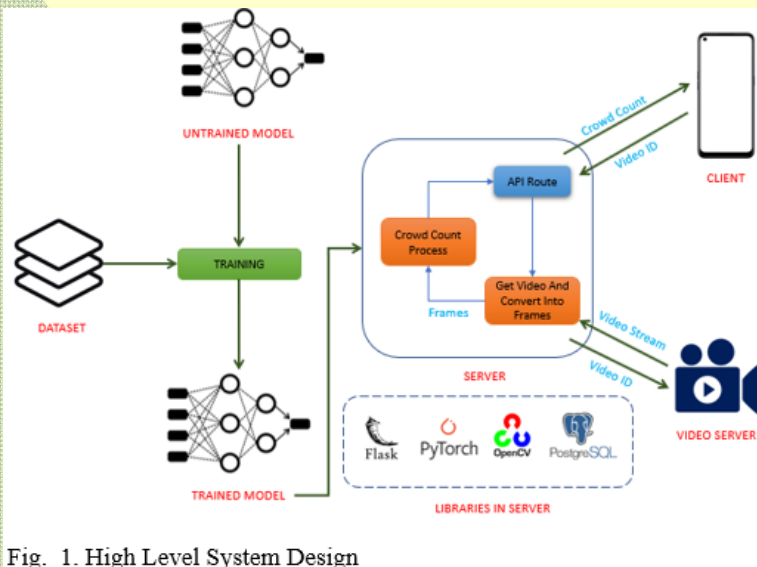


Fig. 1. High Level System Design

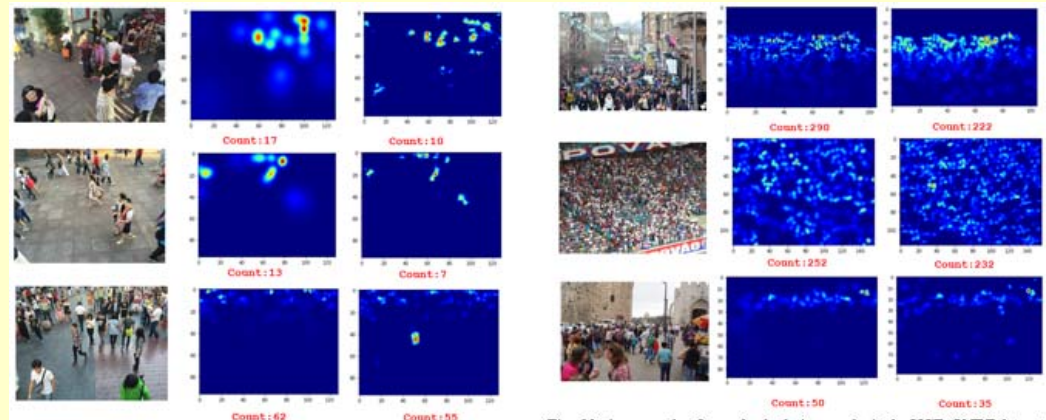


Fig. 10. An example of crowd calculation results in the ShanghaiTech Part B dataset. Where the first column shows the original image, the second column shows the ground-truth density map along with the number of crowds, while the third column shows the density map prediction results along with the number of crowds. The count value in the image above is obtained by adding up all pixel values in the density map

Fig. 11. An example of crowd calculation results in the UCF\_QNRF dataset. Where the first column shows the original image, the second column shows the ground-truth density map along with the number of crowds, while the third column shows the density map prediction results along with the number of crowds. The count value in the image above is obtained by adding up all pixel values in the density map.

# Javanese Sript Text Image Recognition Using Convolutional Neural Networks

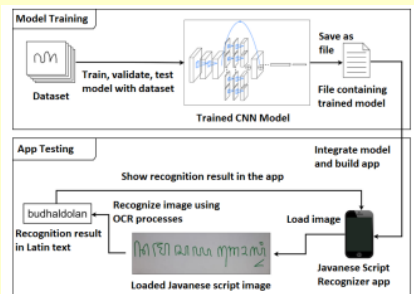


Fig. 1. Research methodology consisting of model training and app development stages.

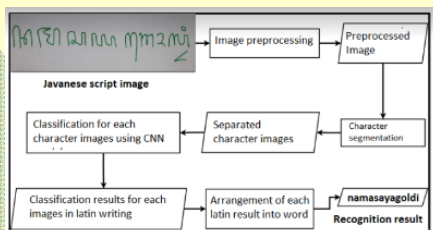


Fig. 5. Flow diagram of the OCR process in the application.

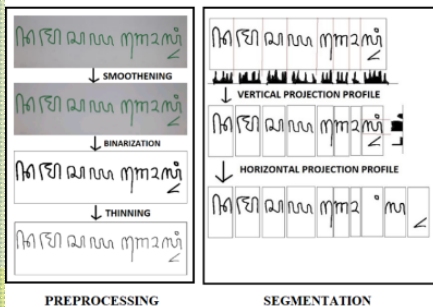


Fig. 6. Detail of preprocessing (left) and segmentation (right) processes.



Fig. 2. Some examples of actual images (red) and augmented images (blue).

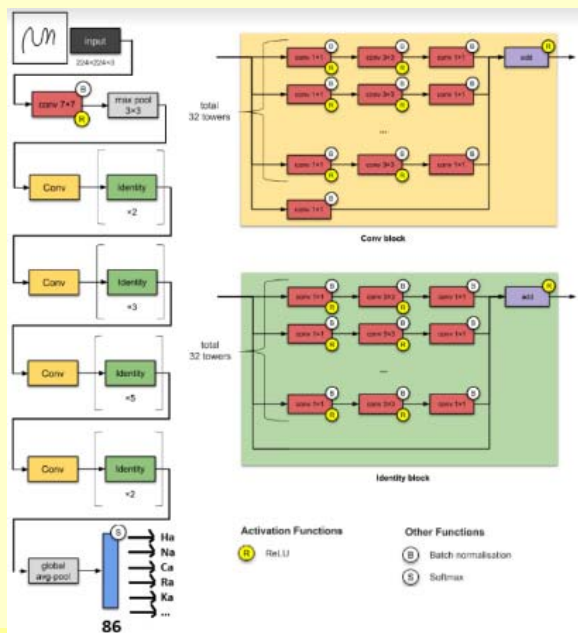


Fig. 4. A visualization of the ResNeXt-50 CNN model architecture [10] with slight modification on the fully connected layer.

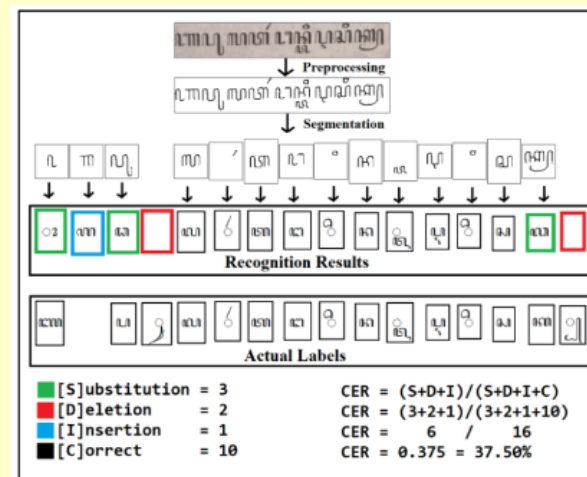


Fig. 10. Character error rate calculation example.

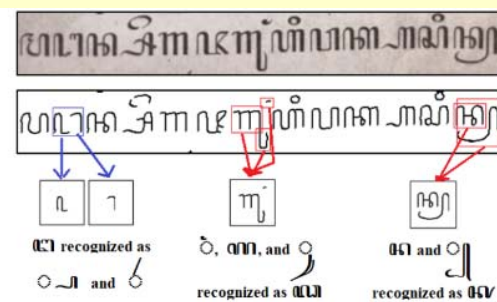
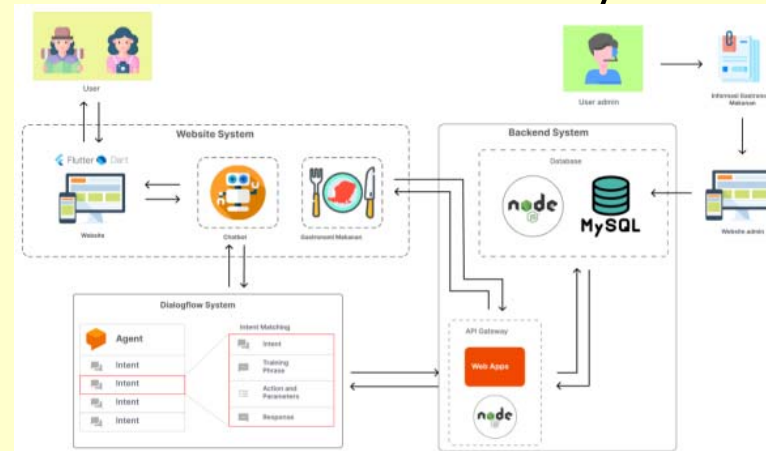
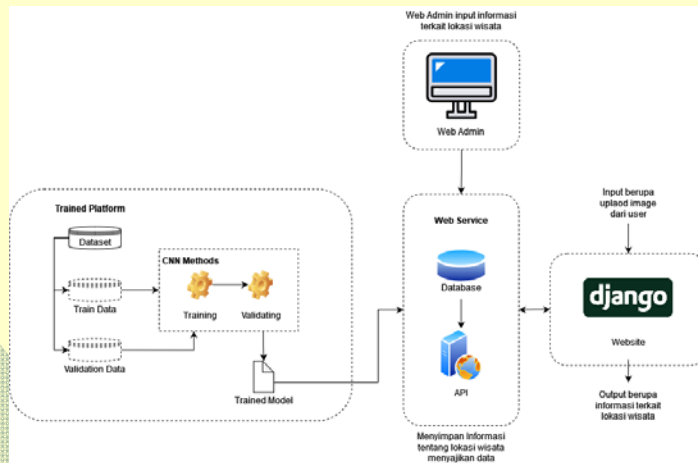


Fig. 11. Example of over-segmentation (blue) and under-segmentation (red) resulting in recognition errors.



# Thoughtful Indonesia Tourism

## Tourism Place Identification & Food Gastronomy

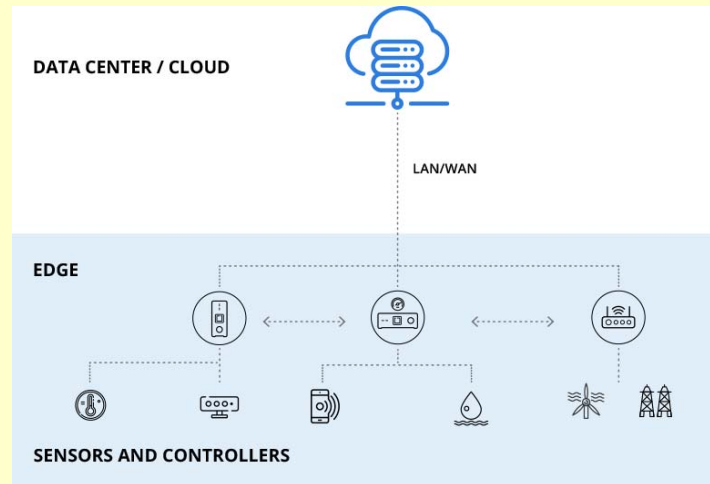




# Human Detection for Security Surveillance

# Helm Keselamatan di Area Konstruksi

## NVIDIA Jetson





# Project Application (Earthquake Analysis)

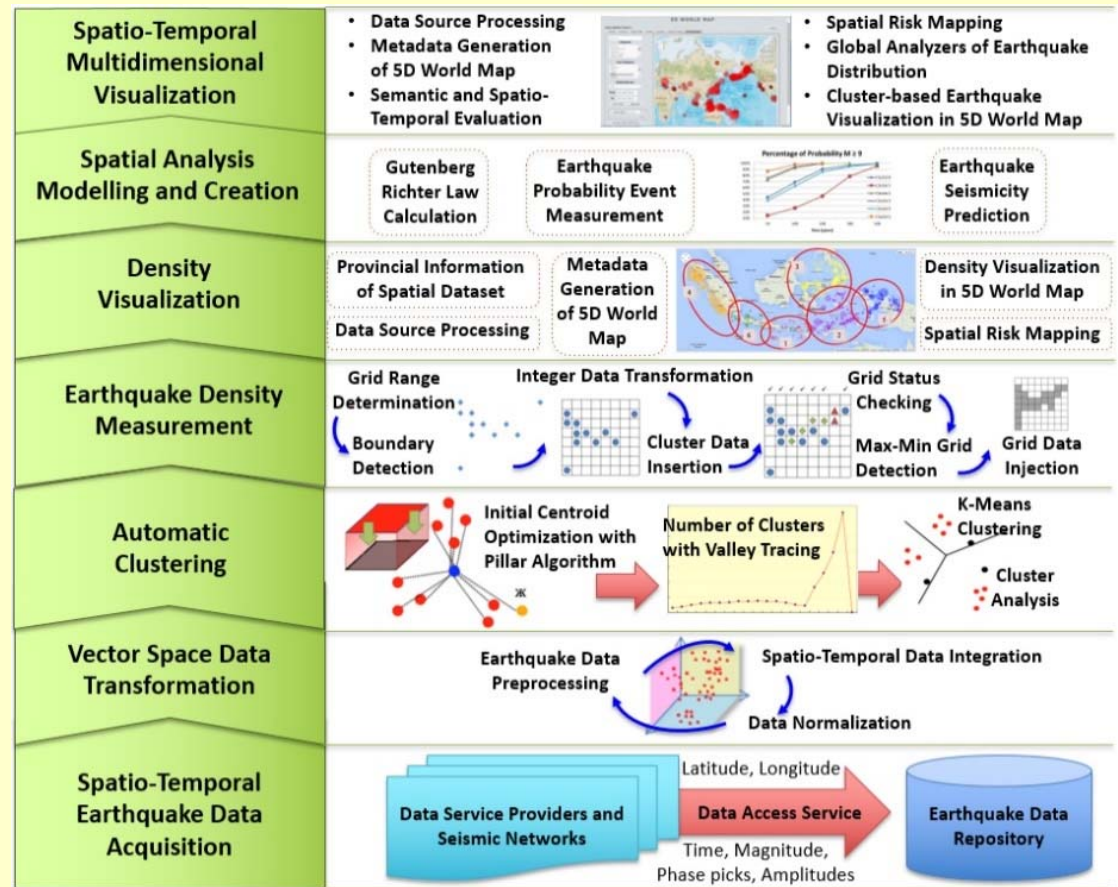
National Fund, 2017-2019  
 Penelitian Terapan Unggulan  
 Perguruan Tinggi

This research presents a design and development of automatic clustering for spatial analysis and risk mapping of earthquake distribution. In this research, a new clustering algorithm is presented that is able to make clustering with detecting automatically number of clusters.

## INSTITUTION

Knowledge Engineering Research Group, PENS  
 Hazard & Disaster Research Center, PENS  
 Ubiquitous services Research center, PENS  
 Multimedia & Data Mining Research Lab., Keio Univ.

## Design and Development of Automatic Clustering for Spatial Analysis and Risk Mapping of Earthquake Distribution



# Project on Deforestation Measurement

## Collaborative Work:

- Politeknik Elektronika Negeri Surabaya
- Keio University
- Chulalongkorn University

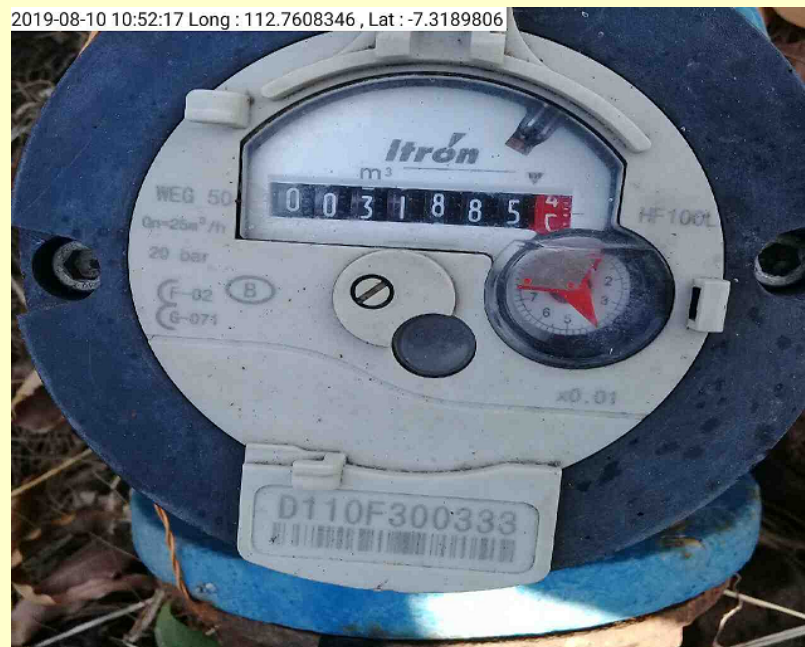
Location in 4 National Parks in Thailand



2003	2004	2005	2006
2007	2008	2009	2010
2011	2012	2013	

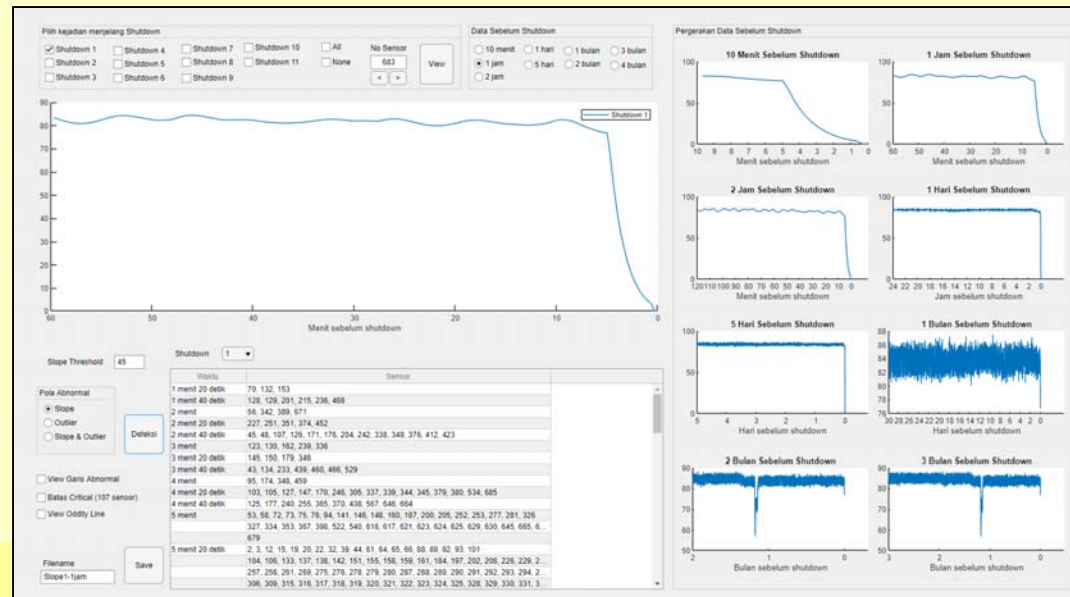
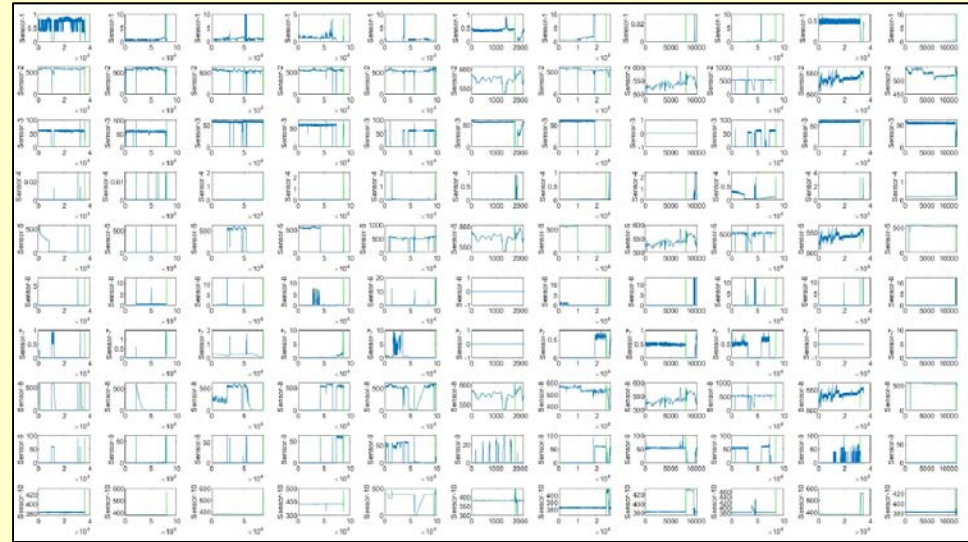
# Rekognisi Angka Meteran dengan local feature extraction pada mobile device

Proyek Kerjasama dengan PDAM

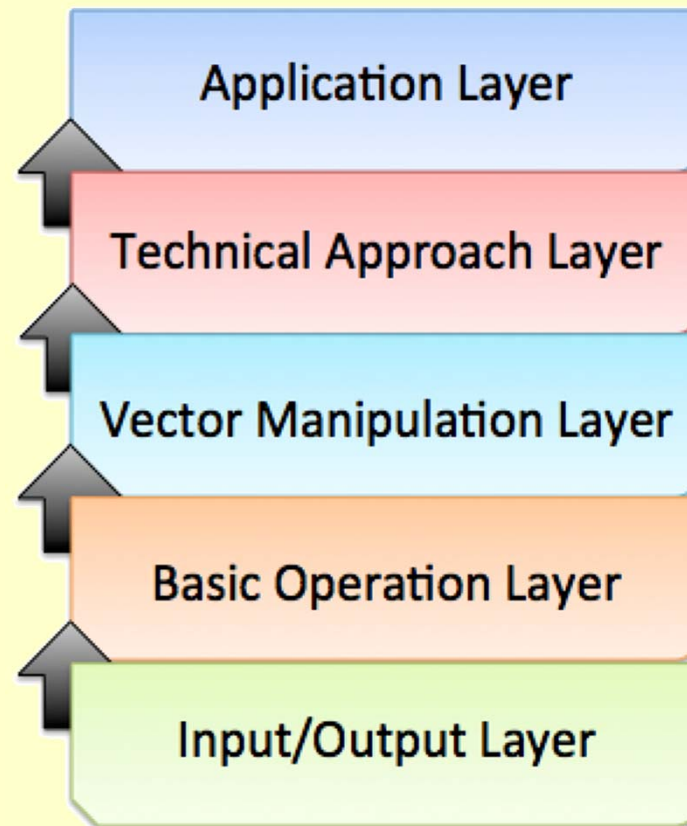


# Root cause analysis: Sensor based factory shutdown identification

- Data Analytics untuk Root-Cause Analysis dalam identifikasi penyebab shutdown pabrik
- Proyek Kerjasama dengan Pupuk Kaltim
- Pengamatan melibatkan 685 sensor selama 5 tahun dengan basis waktu per 5 menit, per 20 detik dan per detik



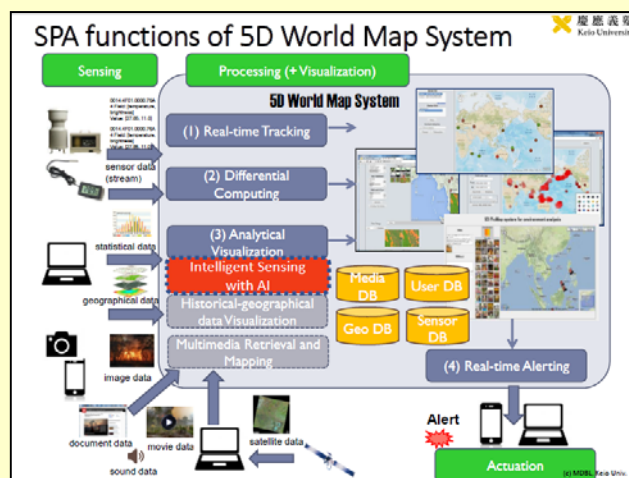
- Pengembangan Libraries untuk Machine Learning, Data Mining, Data Science, Computational Linguistics
- Berbasis Java



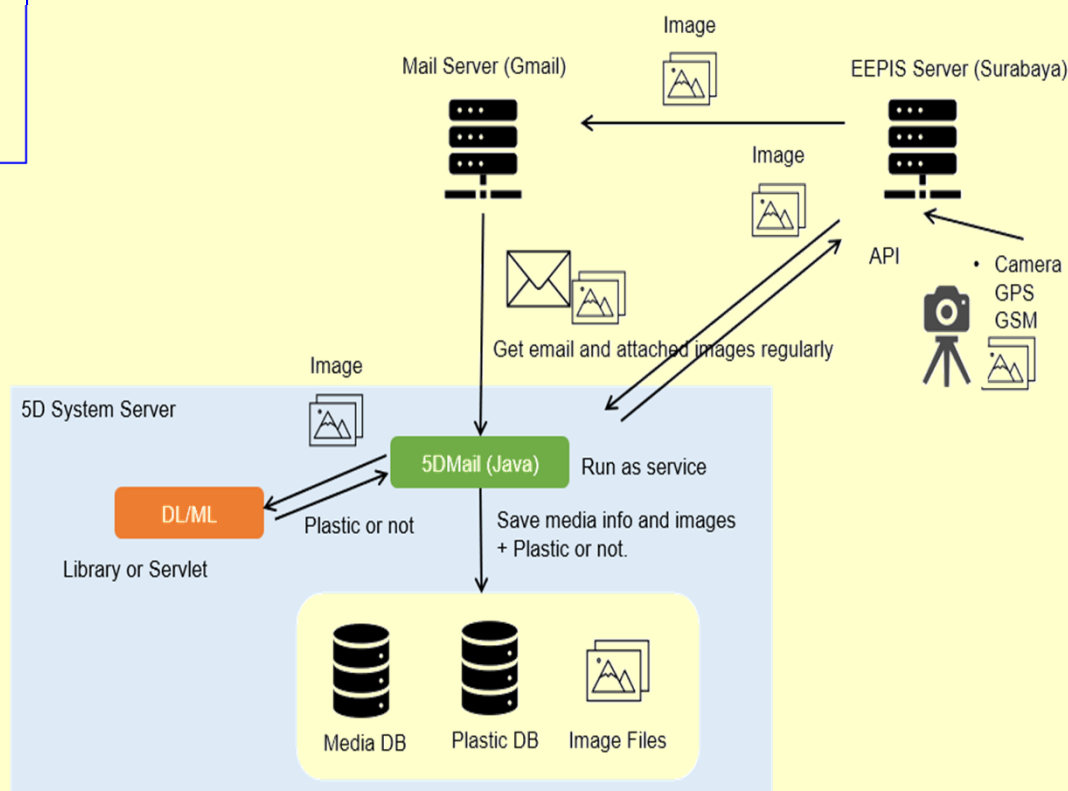
# Pengembangan Data Analytics untuk Monitoring Sampah Plastik

## Collaborative Work:

- United Nations ESCAP (Economic and Social Commission for Asia and the Pacific)
- Keio University, Japan
- Musashino University, Japan
- Politeknik Elektronika Negeri Surabaya
- Kasetsart University, Thailand



## Aplikasi Web & Pemrograman Server



# On Progress

1. Iridology for health condition
  - 2023 : Data engineering & modeling for cholesterol, stomach condition
  - 2024 : Data engineering & modeling for heart, diabetes disease
  - 2025 : Data engineering & modeling sclera
  - 2026 : MLOps for iridology
2. Language computational on chatbot
  - 2023 : Development of Text Processing Library
  - 2024 : Modeling with ML methods
  - 2025 : MLOps for chatbot
3. Chronic Wound Analysis for medical treatment
  - 2022 : Data acquisition & preparation
  - 2023 : System Modelling & Analysis
  - 2024 : + Using IoT
4. Convolutional Neural Networks Library based on Java Programming Language
5. Tourism Place Recognition for Supporting Thoughtful Indonesia







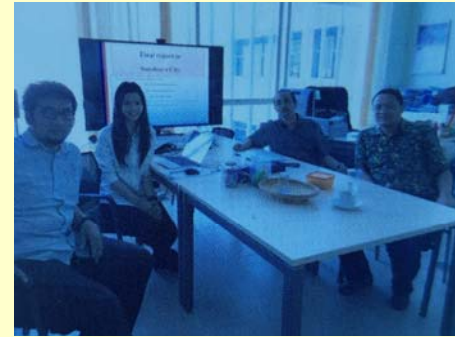
## Visiting Researcher

Mohammad Nur Shodiq & Dedy Hidayat Kusuma (Lecturer, Banyuwangi State Polytechnic) July 2017

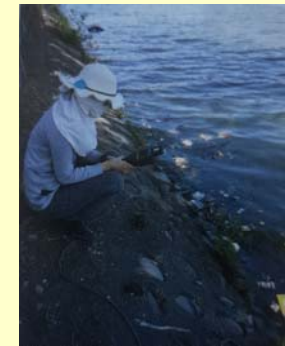


Following visiting researcher program at Knowing Lab. and conducting research collaboration on spatial analysis of earthquake

## Student Exchange



Following internship program at Knowing Lab. for 1.5 months and conducting research on river water-quality measurement and analysis in Surabaya



**Chalisa Veesommai** (Doctoral student, Keio University) September-October 2015

Sari Inoue (Undergraduate Student, Keio University) March 2019



Internship in Lab. Knowing Lab for conducting research in data analytics for context-based acquisition systems



**Siti Nor Khuzaimah** (Doctoral student, Keio University) November-December 2017



Following internship program at Knowing Lab. for 2 months and conducting research on damage measurement of disaster with intelligent computing approaches (image processing, classification model, automatic clustering, deep learning)



Politeknik Elektronika Negeri Surabaya

Knowledge Engineering (knowing) Research Group



# Knowledge Engineering Research Group

*...intelligent computing to knowledge creation...*

tita@pens.ac.id



Politeknik Elektronika  
Negeri Surabaya

Knowledge Engineering  
(knoWing) Research Group

