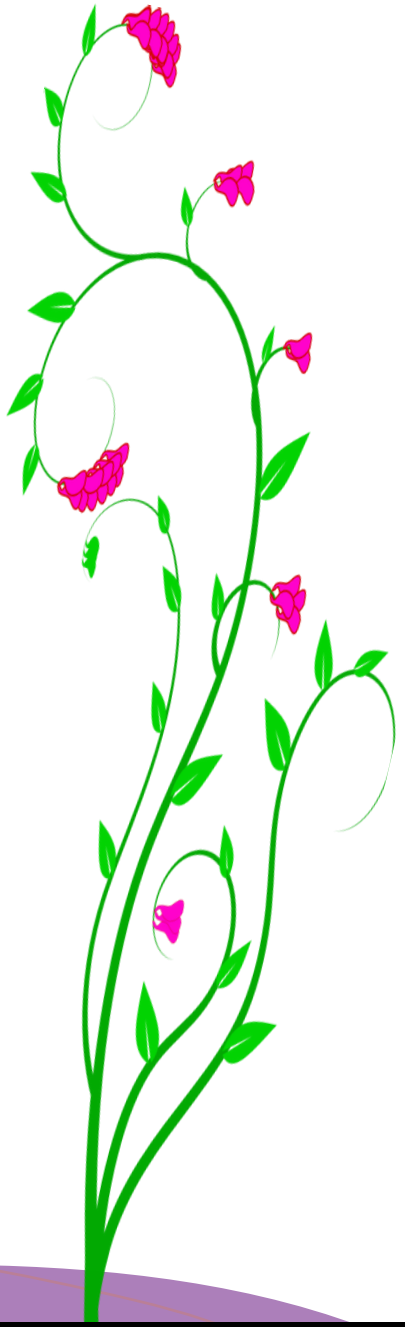
Teknologi Kecerdasan Buatan untuk Mendukung Keputusan pada Bidang Medis

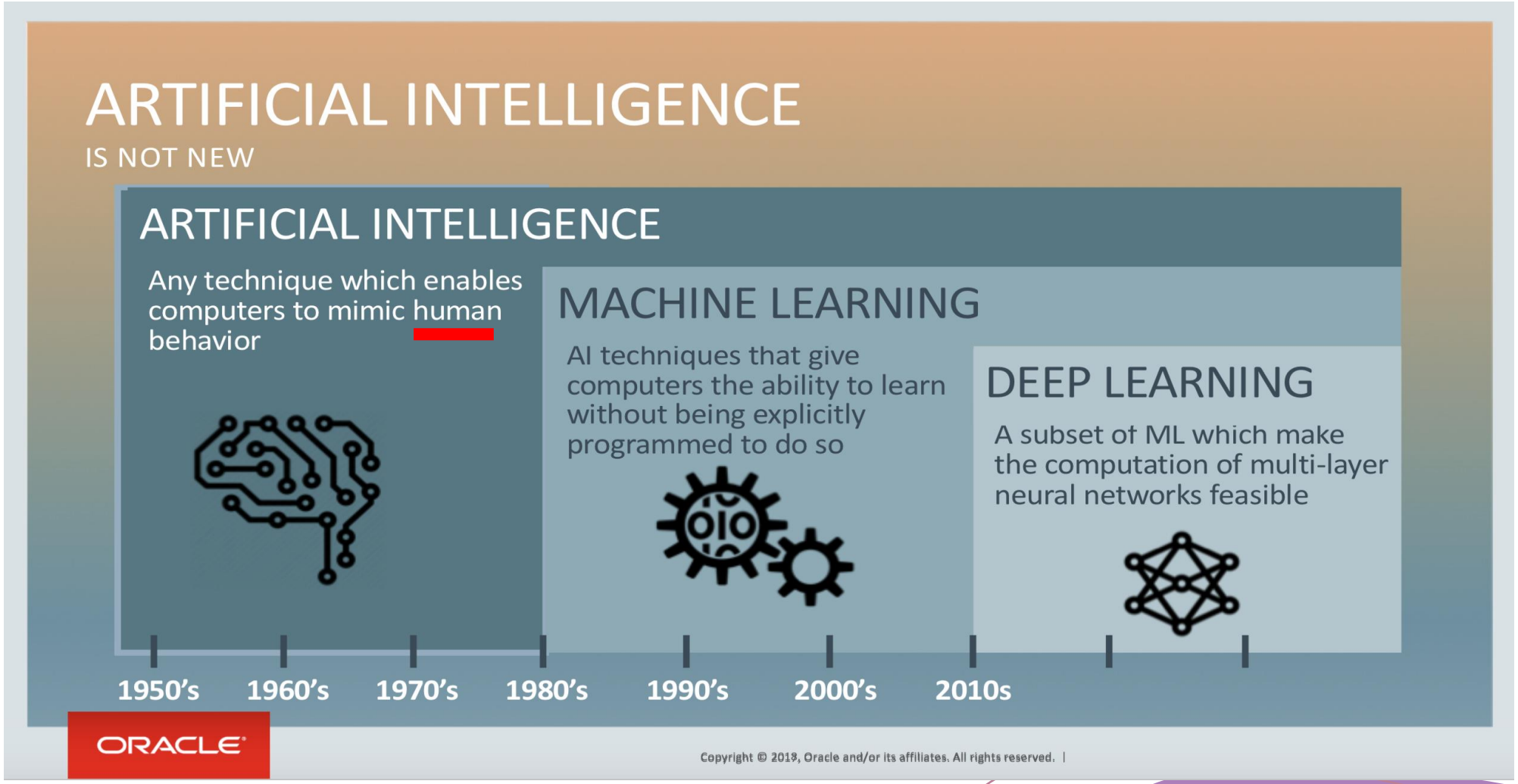
Dr. Enny Itje Sela, S.Si., M. Kom
Universitas Teknologi Yogyakarta



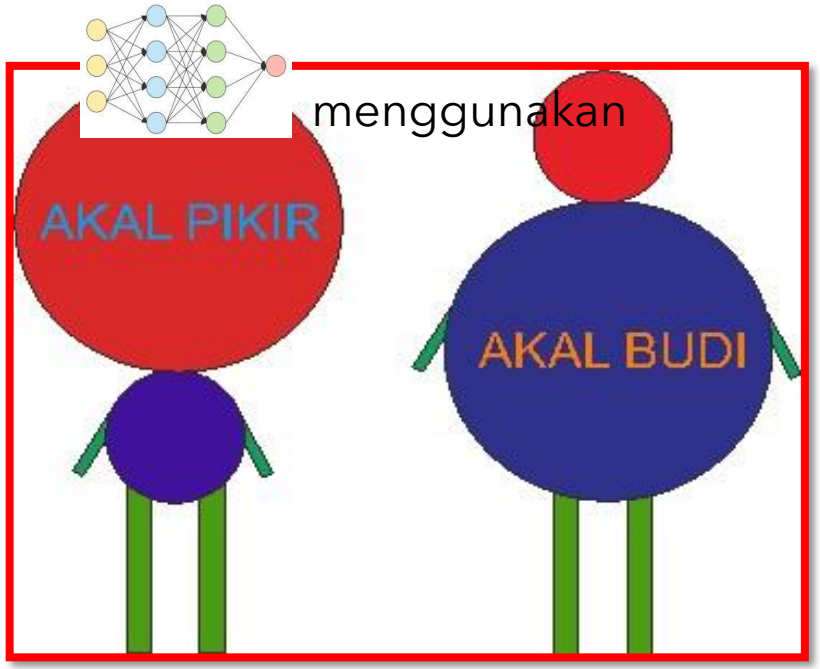
Bahasan

1. Kecerdasan Buatan
2. Machine Learning
3. Studi Kasus

1 Kecerdasan Buatan




Type a messa...
Tap to speak
Didn't catch that. Try speaking again.
Google
Senses
Smoke alarms beep loudly when there is a fire
Taste sensing machine
Insent
Robot


menggunakan
AKAL PIKIR
AKAL BUDI

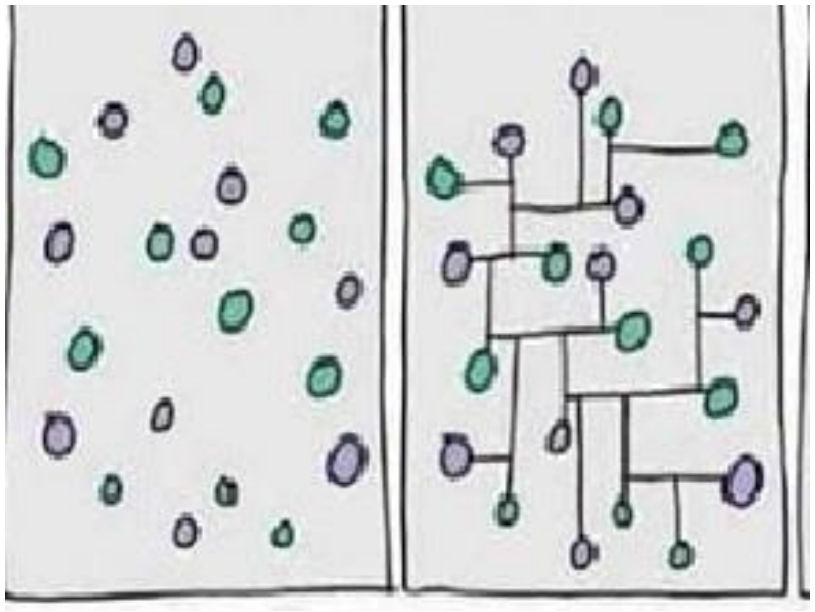

DECISION

AN INTELLIGENT SYSTEM IS A KNOWLEDGE DEVELOPMENT SYSTEM

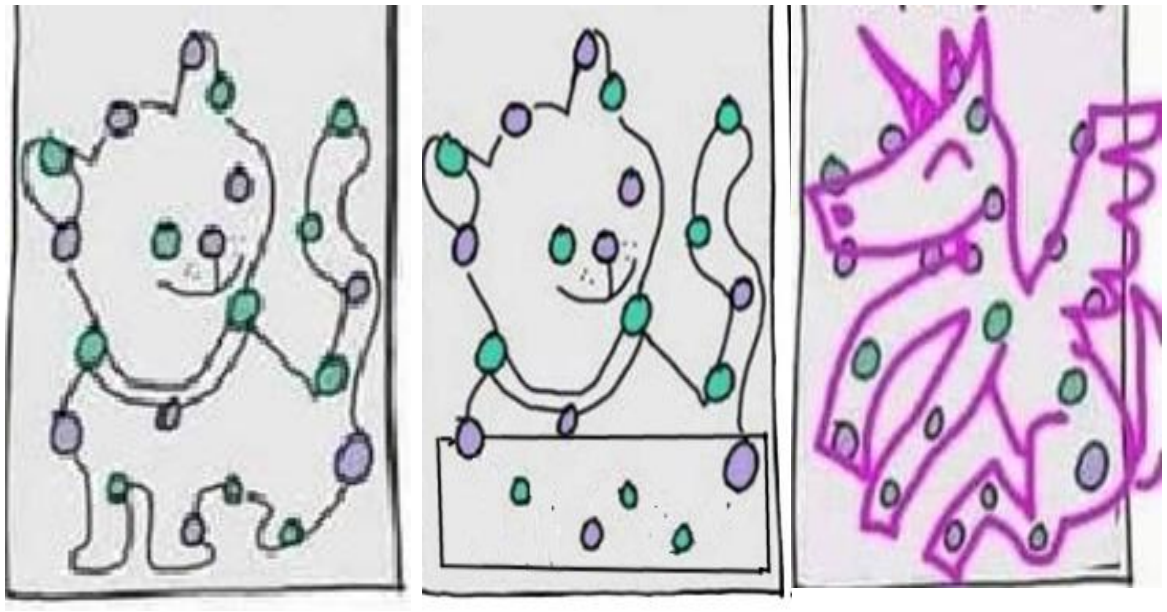

DATA
INFORMASI
PENGETAHUAN

DATA

INFORMASI

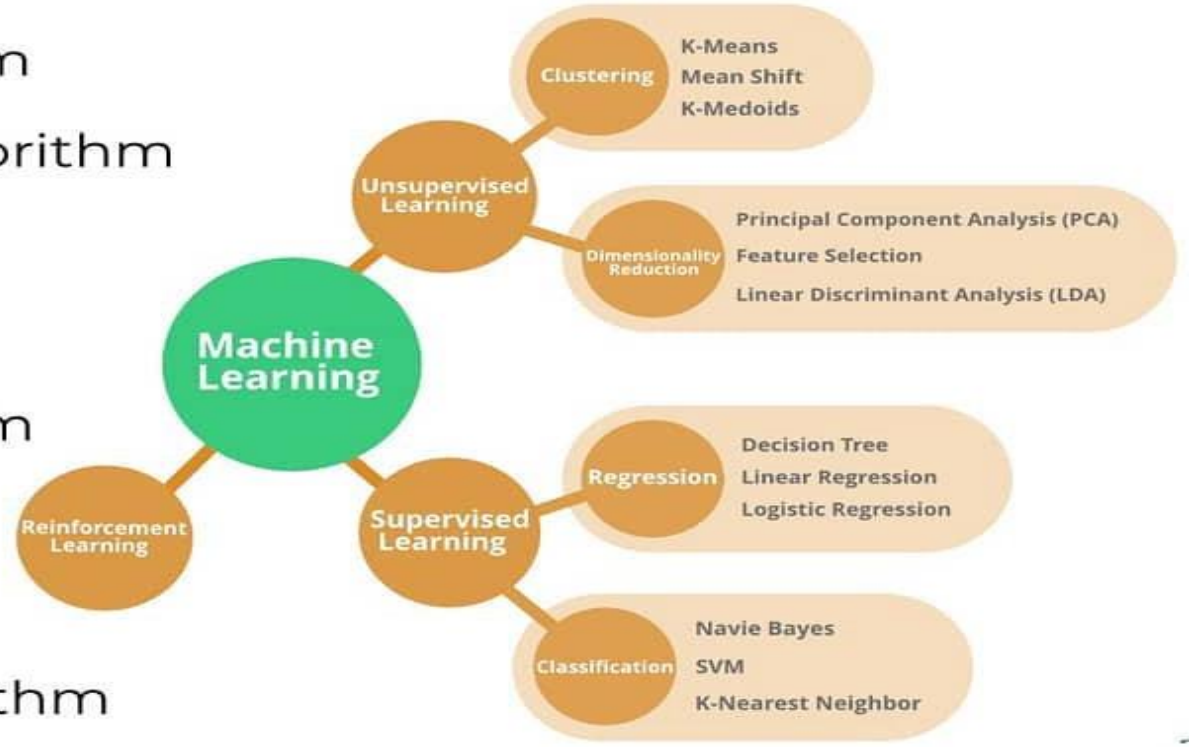


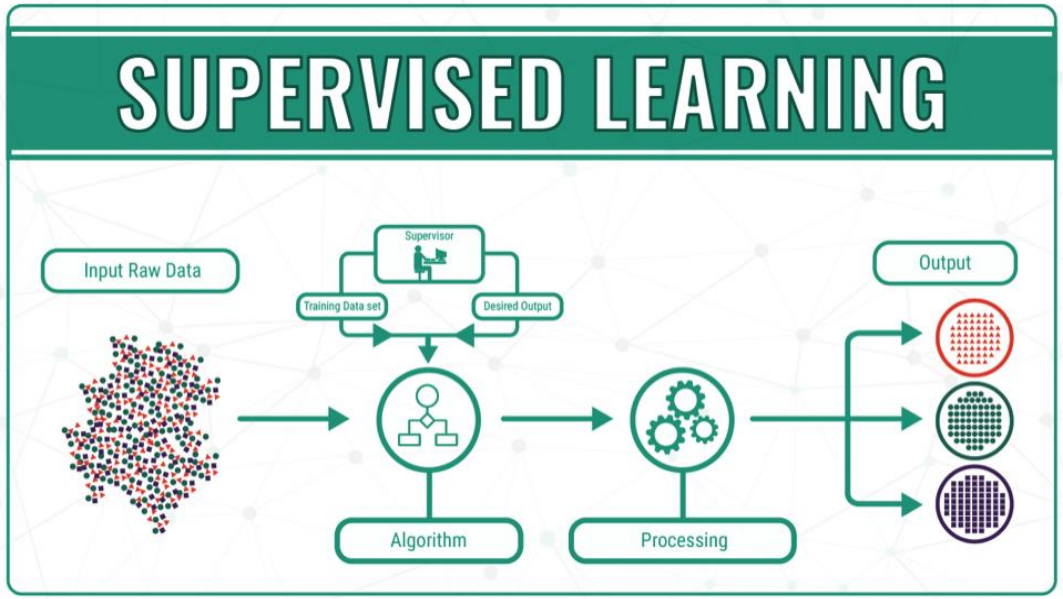
PENGETAHUAN

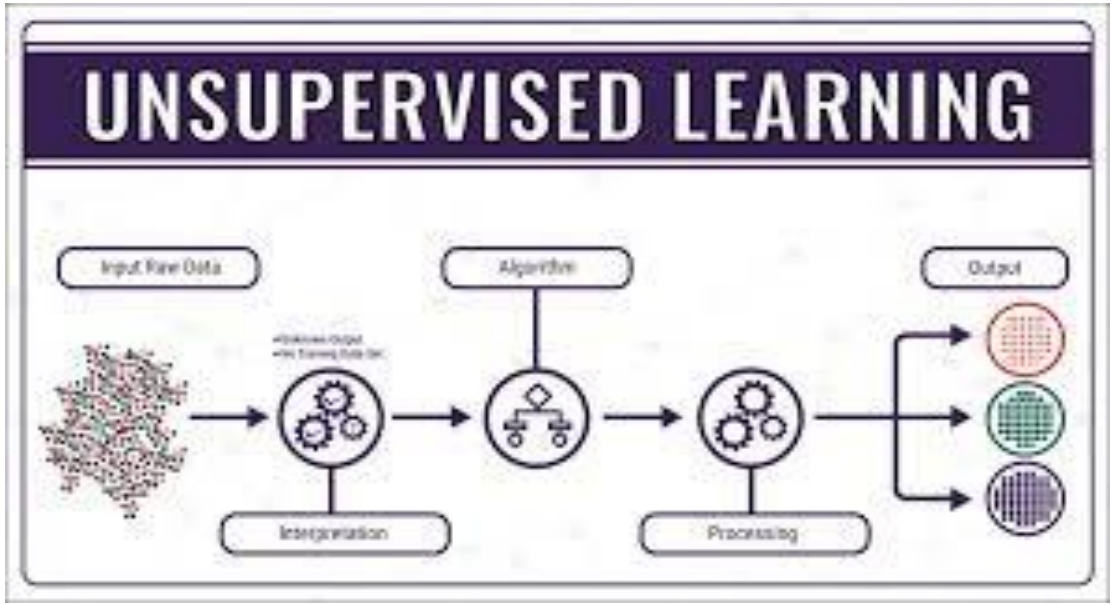


2 Machine Learning

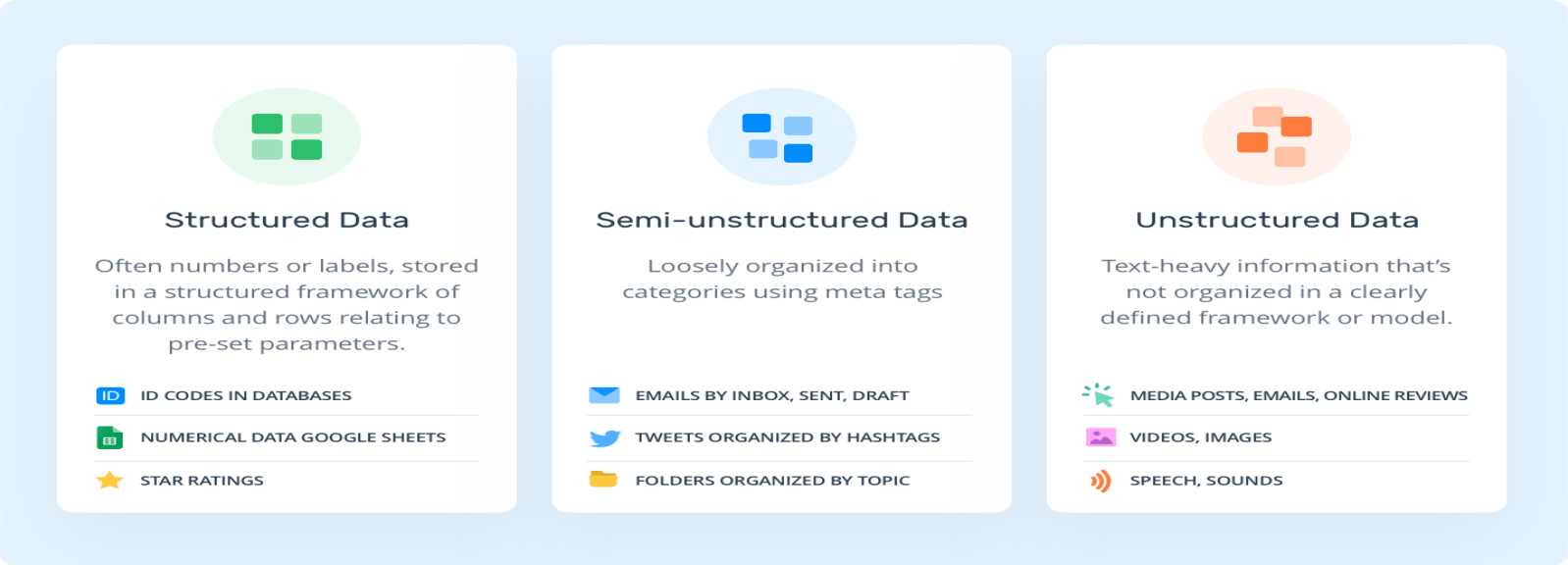
1. Naïve Bayes Classifier Algorithm
2. K Means Clustering Algorithm
3. Support Vector Machine Algorithm
4. Apriori Algorithm
5. Linear Regression Algorithm
6. Logistic Regression Algorithm
7. Decision Trees Algorithm
8. Random Forests Algorithm
9. K Nearest Neighbours Algorithm
10. Artificial Neural Networks Algorithm




SUPERVISED LEARNING
Input Raw Data
Supervisor
Training Data set
Desired Output
Algorithm
Processing
Output


UNSUPERVISED LEARNING
Input Raw Data
Algorithm
Output
Interpretation
Processing

JENIS DATA



ID	Name	Age	Degree
1	John	18	B.Sc.
2	David	31	Ph.D.
3	Robert	51	Ph.D.
4	Rick	26	M.Sc.
5	Michael	19	B.Sc.

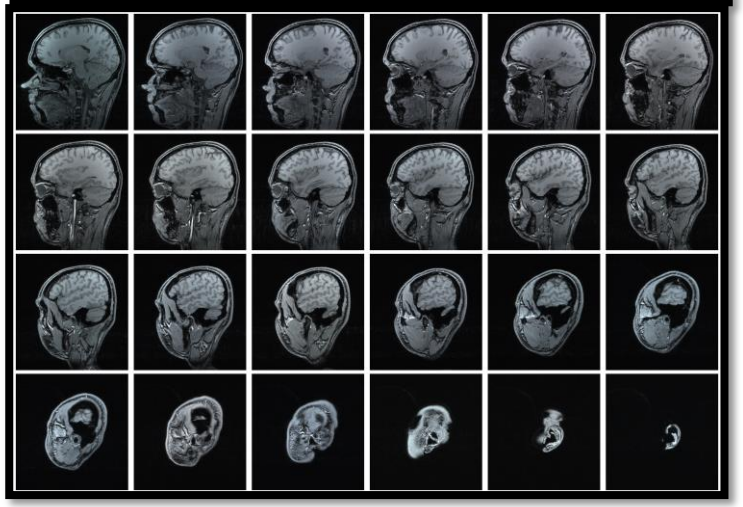
```
<University>
  <Student ID="1">
    <Name>John</Name>
    <Age>18</Age>
    <Degree>B.Sc.</Degree>
  </Student>
  <Student ID="2">
    <Name>David</Name>
    <Age>31</Age>
    <Degree>Ph.D. </Degree>
 </Student>
....
</University>
```

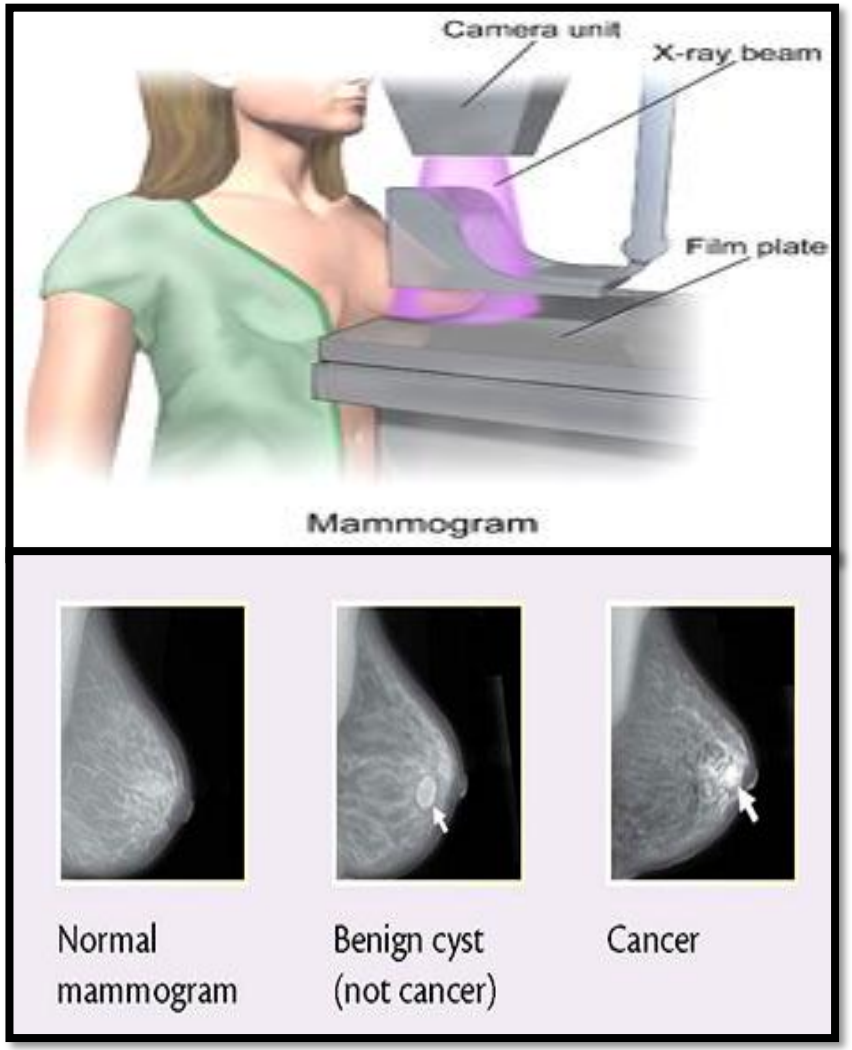
The university has 5600 students.
John's ID is number 1, he is 18 years old and already holds a B.Sc. degree.
David's ID is number 2, he is 31 years old and holds a Ph.D. degree. Robert's ID is number 3, he is 51 years old and also holds the same degree as David, a Ph.D. degree.

Data Medis

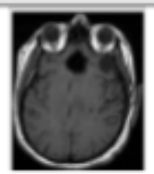
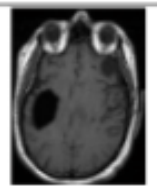
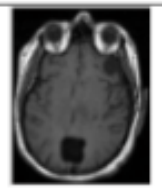
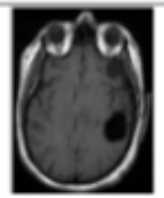
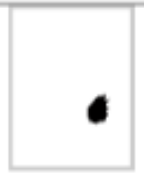
- Data non citra: rekam medis, resep dokter
- Citra: dihasilkan oleh peralatan medis seperti X-ray, CT scan, MRI dll.
- Format citranya khusus untuk citra medis yaitu DICOM (Digital Imaging and Communication in Medicine)
- Citra medis X-ray dapat ditemui dalam bidang radiologi (salah satunya).
- Pembacaan citra medis biasanya dilakukan oleh ahli radiografi atau teknolog radiologis atau radiografer.

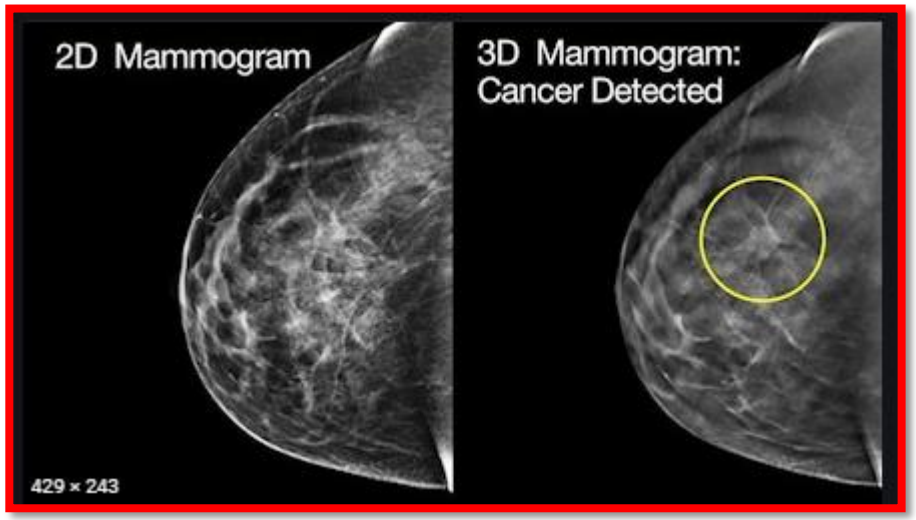
Sumber data medis





Deteksi objek abnormal

No	Citra abnormal	Deteksi	Ukuran
1			z1 = 810.500 z = 4,26% Ukuran kecil
2			z1 = 902.750 z = 4,74% Ukuran kecil
3			z1 = 691.875 z = 3,63% Ukuran kecil
4			z1 = 619.375 z = 3,25% Ukuran kecil

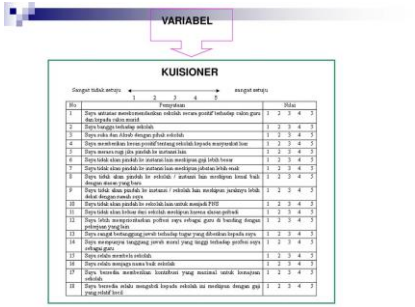


Dataset data terstruktur

UCI Machine Learning Repository

kaggle

Koleksi Data/ Dataset



Pre Procesing

Cleaning, integration, transformation

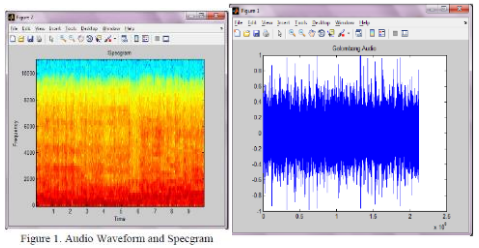
ML

Seleksi Ciri

ML

Training & testing

DATASET PADA DATA TIDAK TERSTRUKTUR



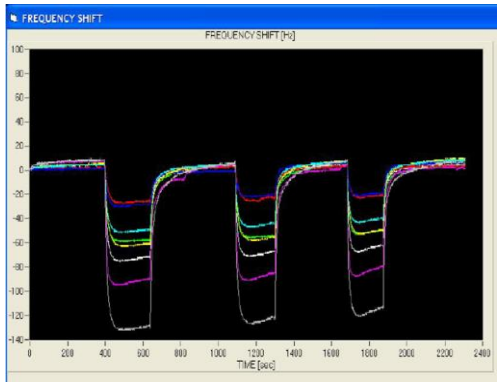
Domain waktu:

average energy (AE),
zero crossing rate (ZCR)

Domain frekuensi:

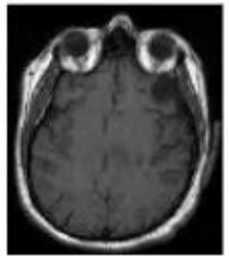
spectrum centroid (SC)
spectrum flux (SF)

AE	ZCR	SC	SF
10.2	111.1	98.2	88
90.1	198.3	80.1	12.2
….			
…..			
….			



S1	S2	S3	S4 ……
10.2	111.1	98.2	88
90.1	198.3	80.1	12.2
….			
…..			
….			

Training & Testing



fitur/ciri : morfologi, tektur, warna,

F1	F2	F3	F4 ……
10.2	111.1	98.2	88
90.1	198.3	80.1	12.2
….			
…..			
….			

3 Studi Kasus

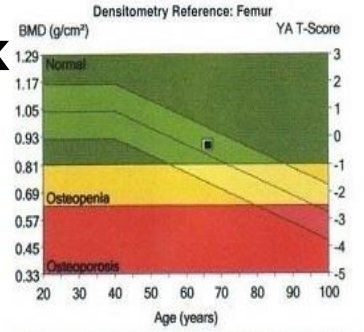
Pemeriksaan Osteoporosis menggunakan Citra Radiograf Periapikal Dental

Latar Belakang

Osteoporosis - DXA

BMD Tlg femoral neck

BMD Tlg lumbar



T-Score, Z-Score (Normal, Osteopenia, Osteoporosis)

DXA gigi

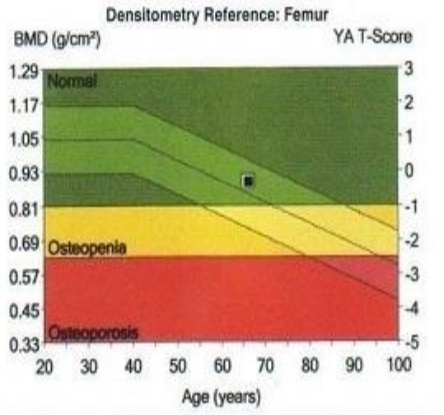
BMD (?)

Normal, Osteopenia, Osteoporosis

Tantangan (1): Data sekunder belum tersedia

Menopause, kriteria eksklusi
informed consent

RSGM Prof Soedomo – FKG - UGM



RSUP Dr. Sardjito - UGM

Pengajuan *ethical clearance*

1
- Proposal :
- Data tersedia:jenis data, jumlah data, peruntukan data, proses data, hasil yang diharapkan
- Data tidak tersedia: kriteria subjek, jumlah subjek, penanganan subjek, ethical cleareance, kuisioner,

2
- Pemeriksaan oleh Komite Etik D:_00UTY\dinas\Pribadi\KSelektaILKOMUGM

3
- Jika lolos, ambil data yang diperlukan

UNIT ETIKA DAN ADVOKASI
FAKULTAS KEDOKTERAN GIGI UNIVERSITAS GADJAH MADA
Sekretariat: Fakultas Kedokteran Gigi UGM Jl. Denta Sekip Utara Yogyakarta
Telp. (0274) 902671

KETERANGAN KELAIKAN ETIK PENELITIAN
("*ETHICAL CLEARANCE*")

No. 296/KKEP/FKG-UGM/EC/2012

Setelah Tim Etik Penelitian Fakultas Kedokteran Gigi Universitas Gadjah Mada mempelajari dengan seksama rancangan penelitian yang diusulkan:

Judul	:"***Framework*** **Sistem Penilaian Kualitas Tulang Trabekula Menggunakan Citra Radiograf Periapikal Dental untuk Pemeriksaan Osteoporosis"**
Peneliti Utama	: Enny Itje Sela
Penanggung Jawab Medis	: 1. Dra. Sri Hartati, M.Sc., Ph.D
	2. Drs. Agus Harjoko, M.Sc., Ph.D
	3. Drs. Retantyo Wardoyo, M.Sc., Ph.D
	4. Prof. Dr. drg. Munakhir Mudjosemedi, SU., Sp.RKG(K)
Unit/Lembaga	: FMIPA UGM
Tempat Penelitian	: Lab. Sistem Cerdas FMIPA UGM
Waktu Penelitian	: Juli 2012 – Desember 2013

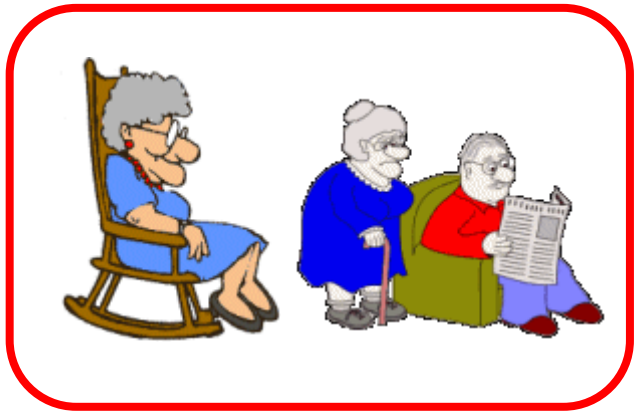
Maka dengan ini menyatakan bahwa penelitian tersebut telah memenuhi syarat atau laik etik.

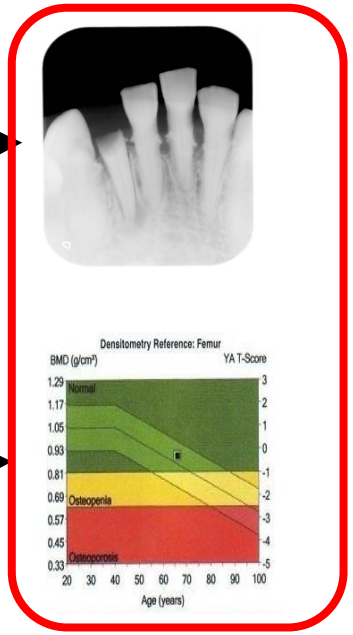
Yogyakarta, 19 Juli 2012

Ketua Komisi Etik Penelitian FKG UGM

drg. Suryono, S.H., Ph.D

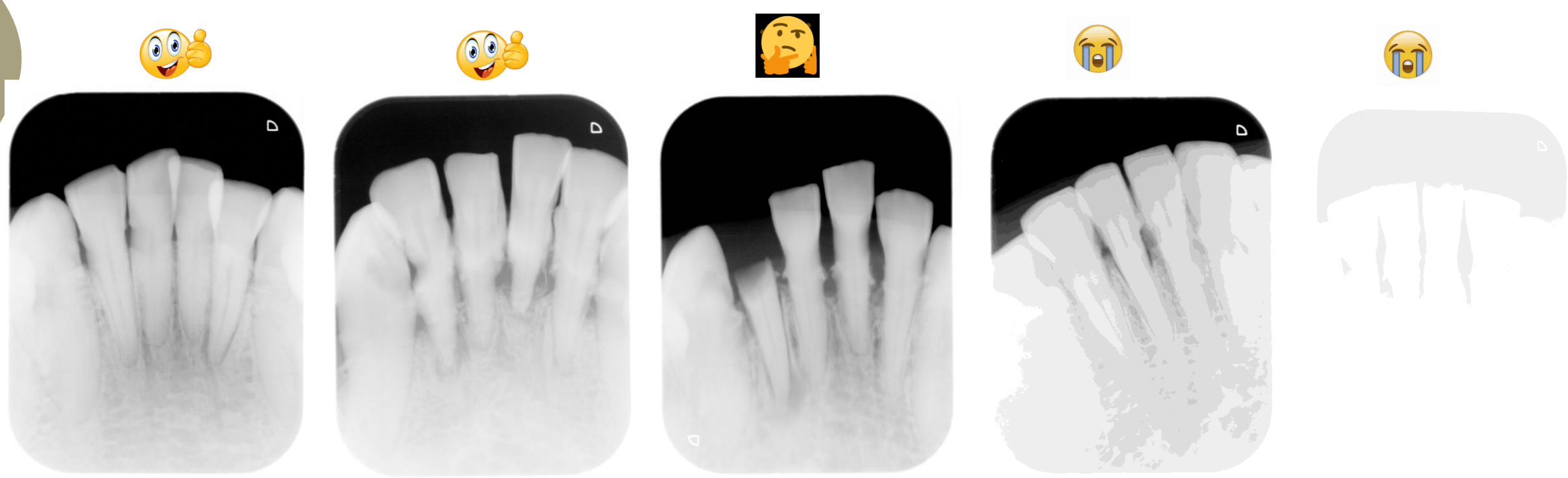
Koleksi data





Akuisisi Citra

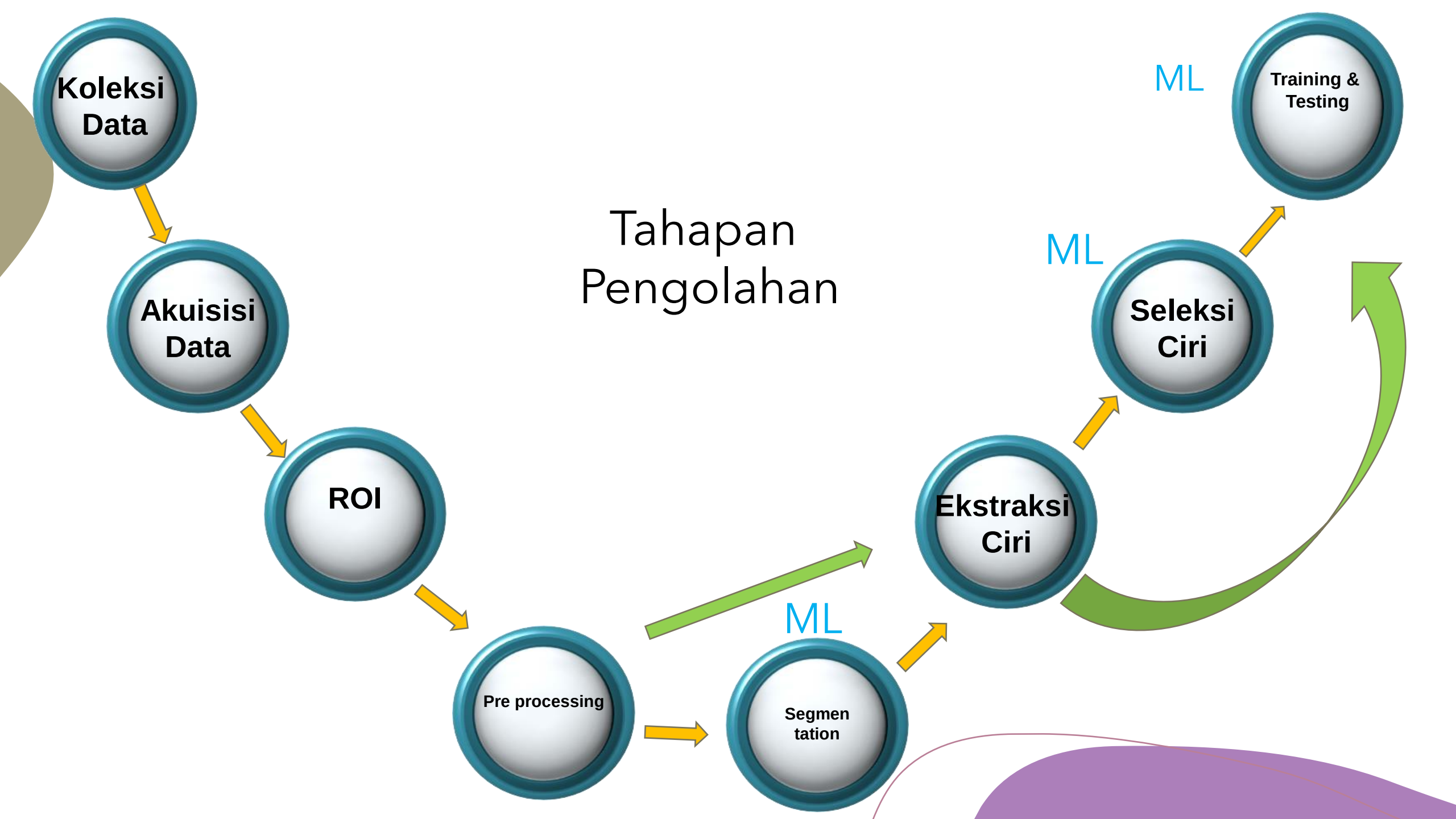
Tantangan (2): Akuisisi Citra



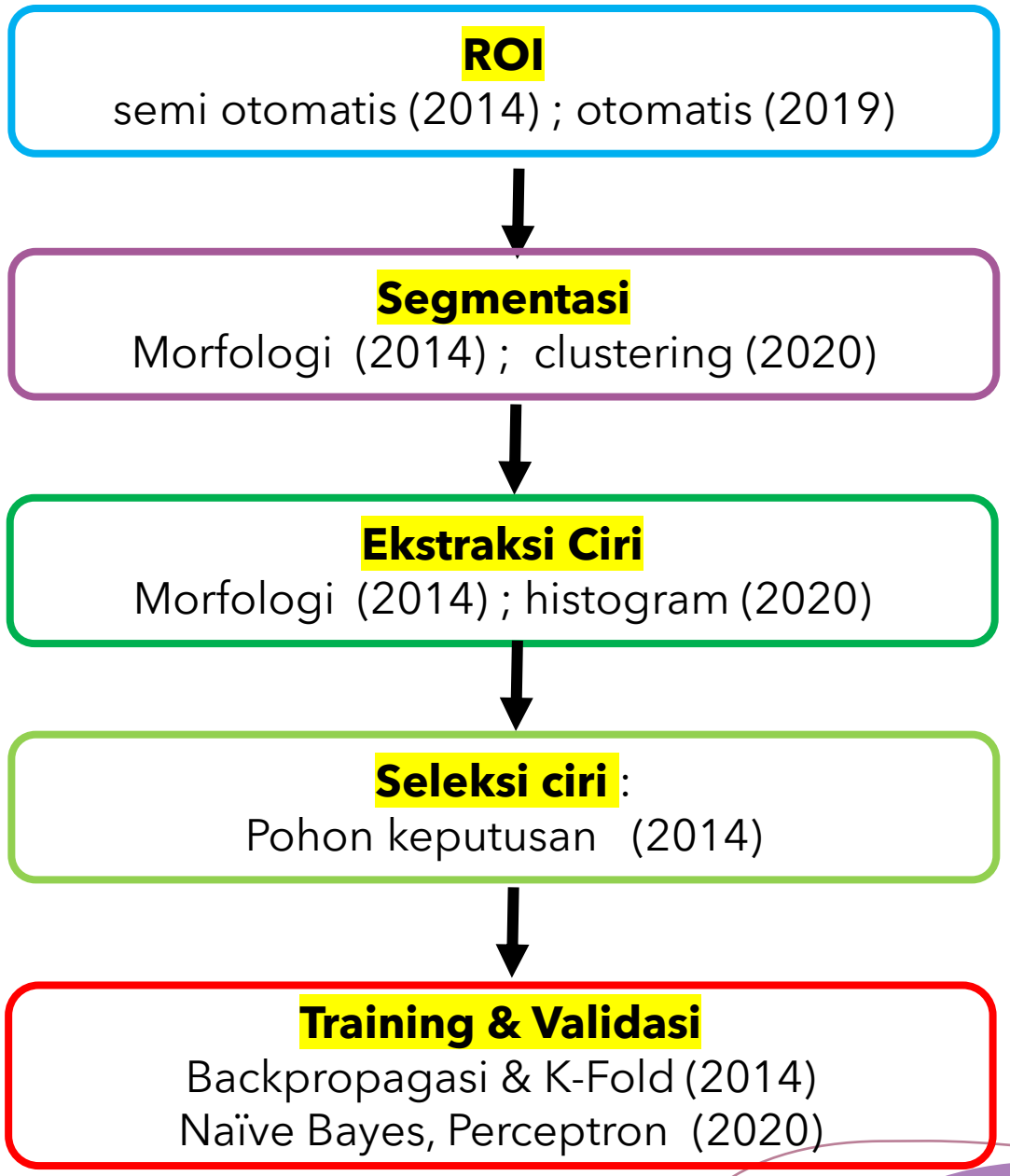
Koleksi citra selesai : **jumlah citra** atau **biaya** 😂

Tetap semangat, jangan putus asa
Tetap putus asa, jangan semangat

Tahapan Pengolahan

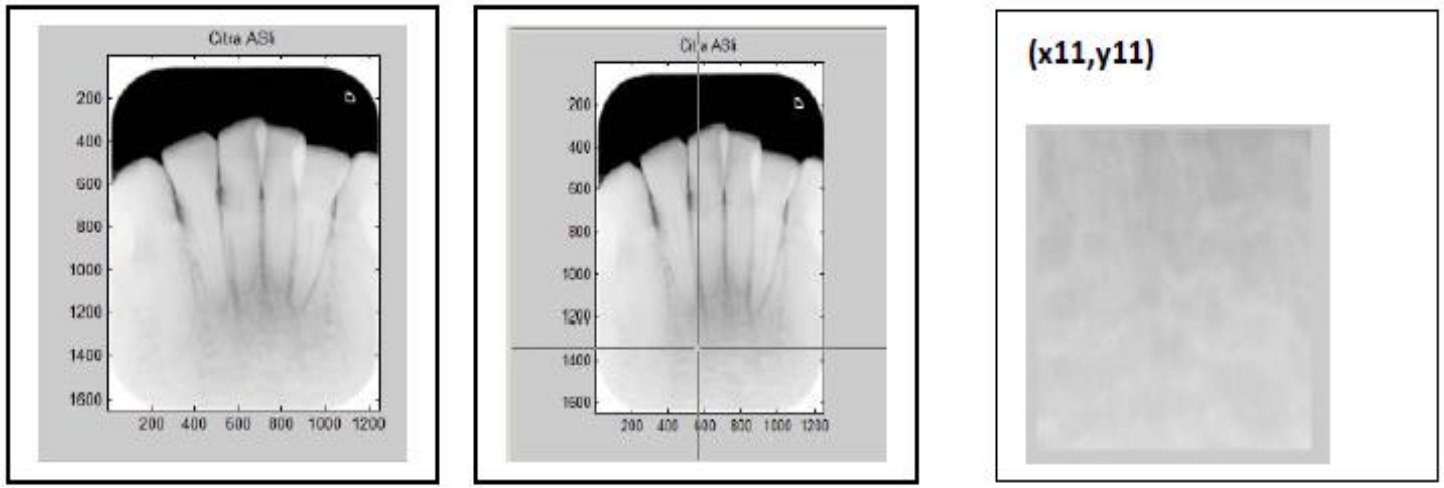


Tantangan (3)
State of the art

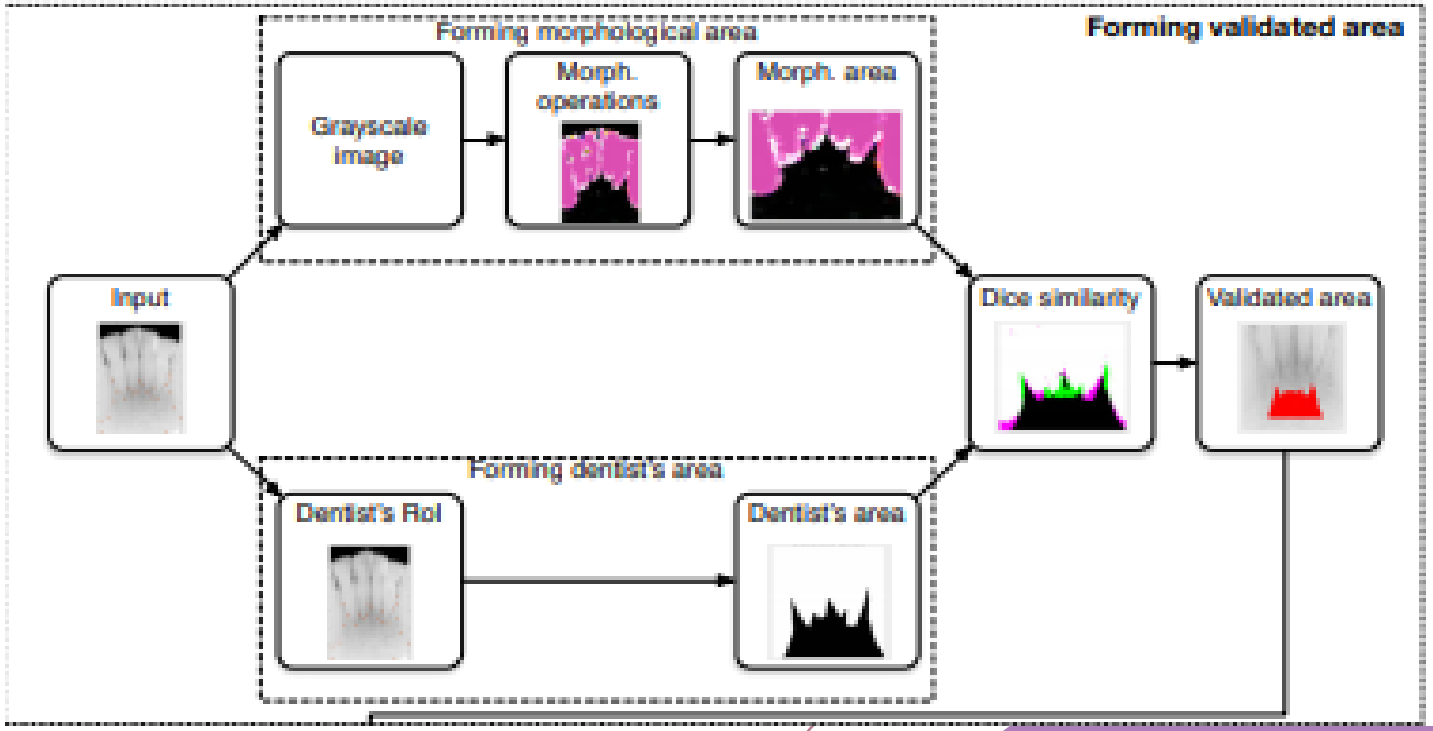


Region of Interest (ROI)

Semi otomatis (2014)



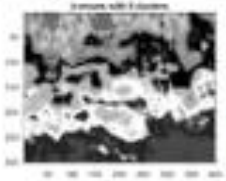
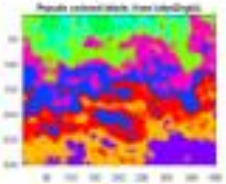
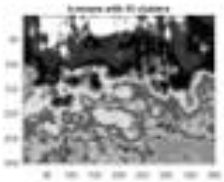
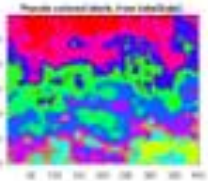
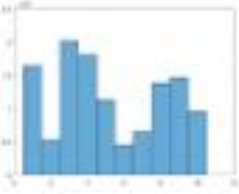
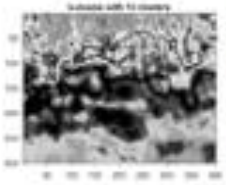
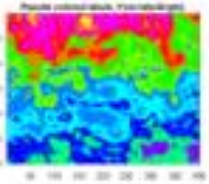
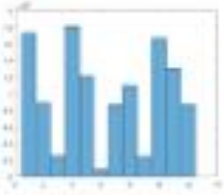
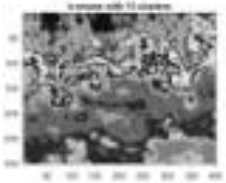
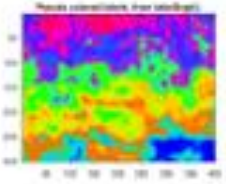
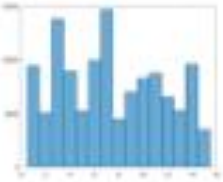
Otomatis (2019)

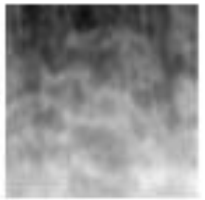
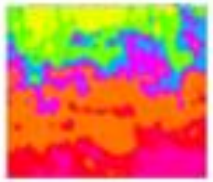
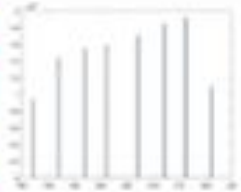
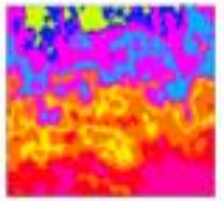
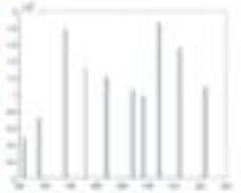
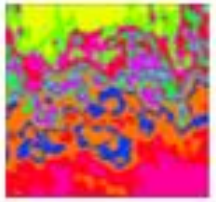
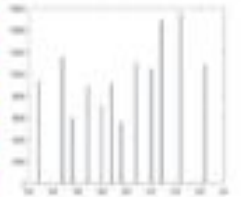
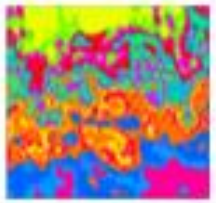
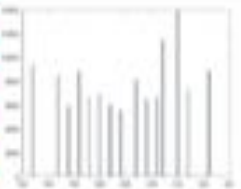


2021

Segmentasi: K-Means & Fuzzy C-Means

Ekstraksi ciri: histogram

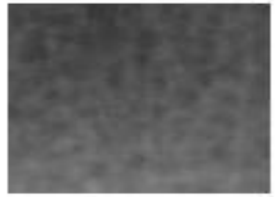
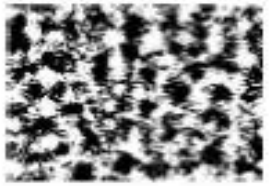
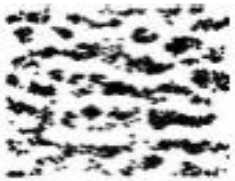
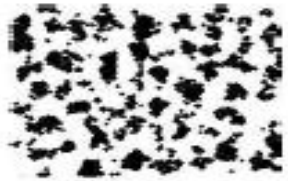
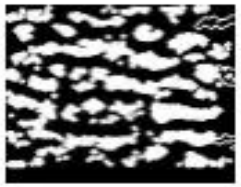
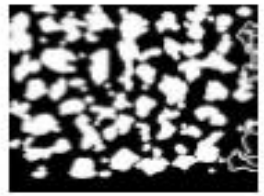
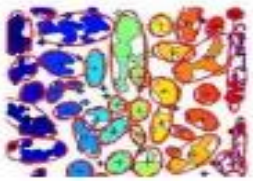
K	ROI	Grayscale segmentation image	Colour segmentation image	Histogram
8				
10				
12				
15				

K	ROI	Grayscale segmentation image	Color segmentation image	Histogram
8				
10				
12				
15				

2014
Pre processing, Segmentasi Ekstraksi ciri

Filtering
morfologi : dilasi, erosi, closing, opening,

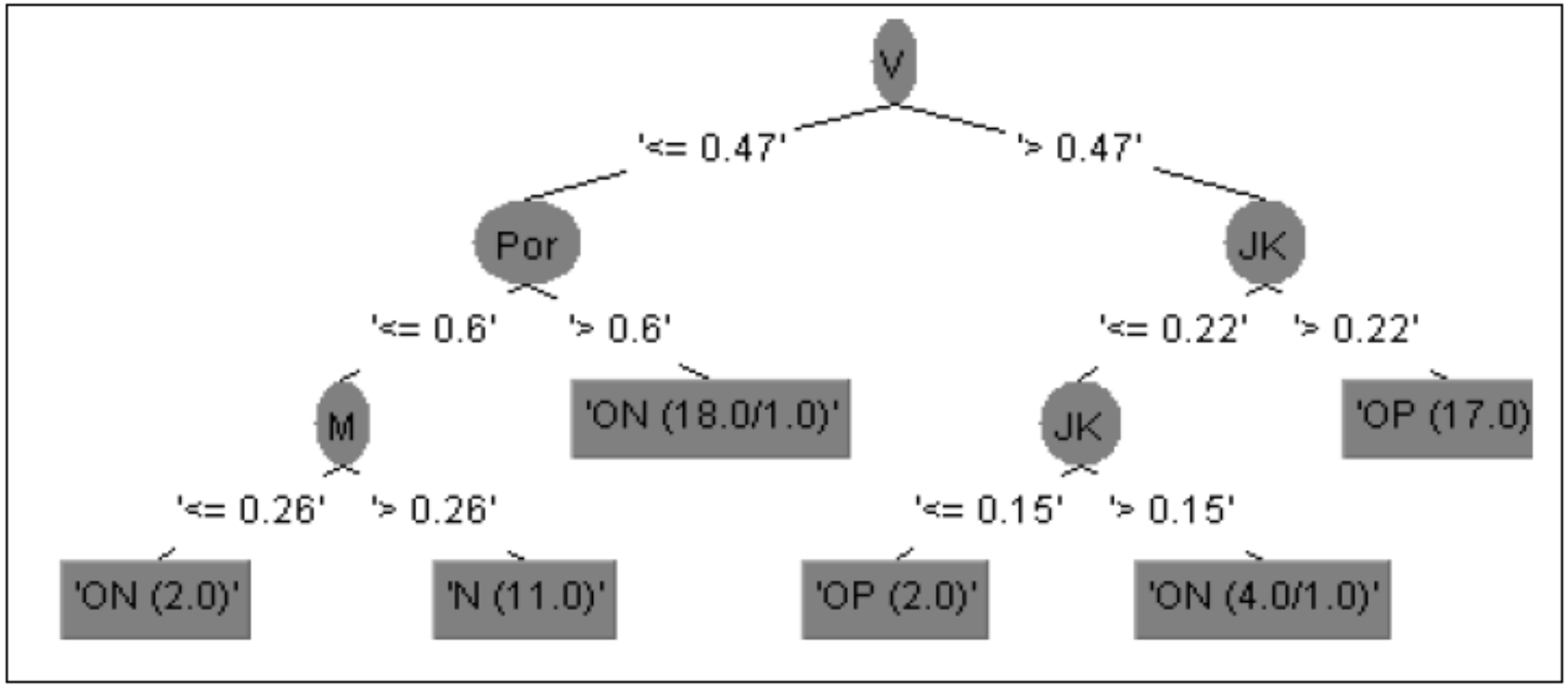
Analisis morfologi

Proses	Kelas Normal	Kelas Osteopenia	Kelas Osteoporosis
Penentuan ROI			
Segmentasi			
Closing			
Deteksi pori dan lubang (pori sesungguhnya)			
Orientasi pori			

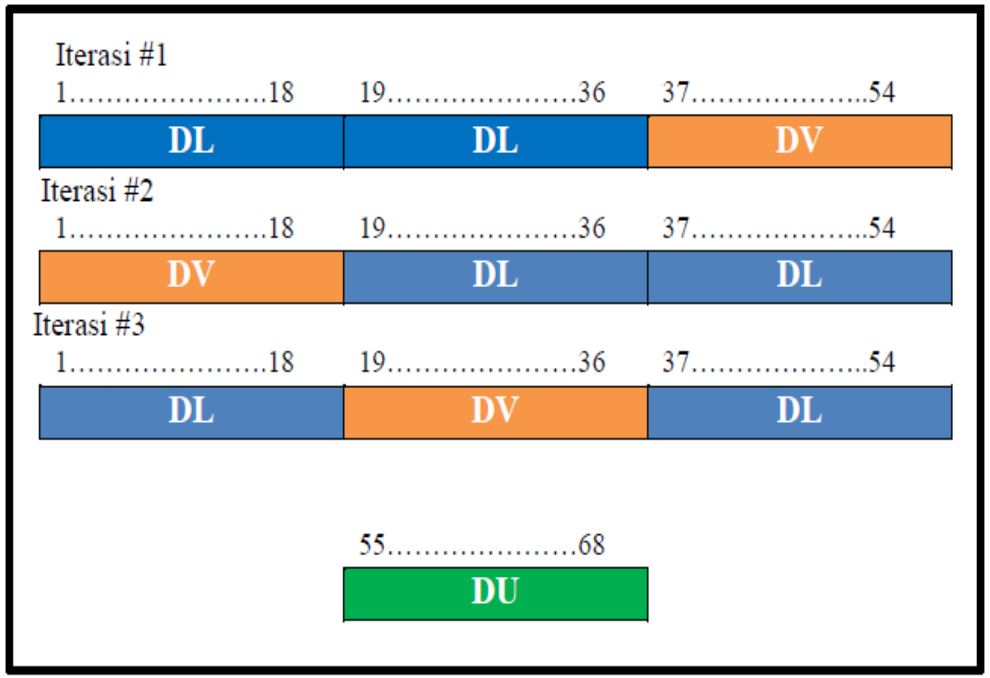
2014
Hasil ekstraksi fitur morfologi

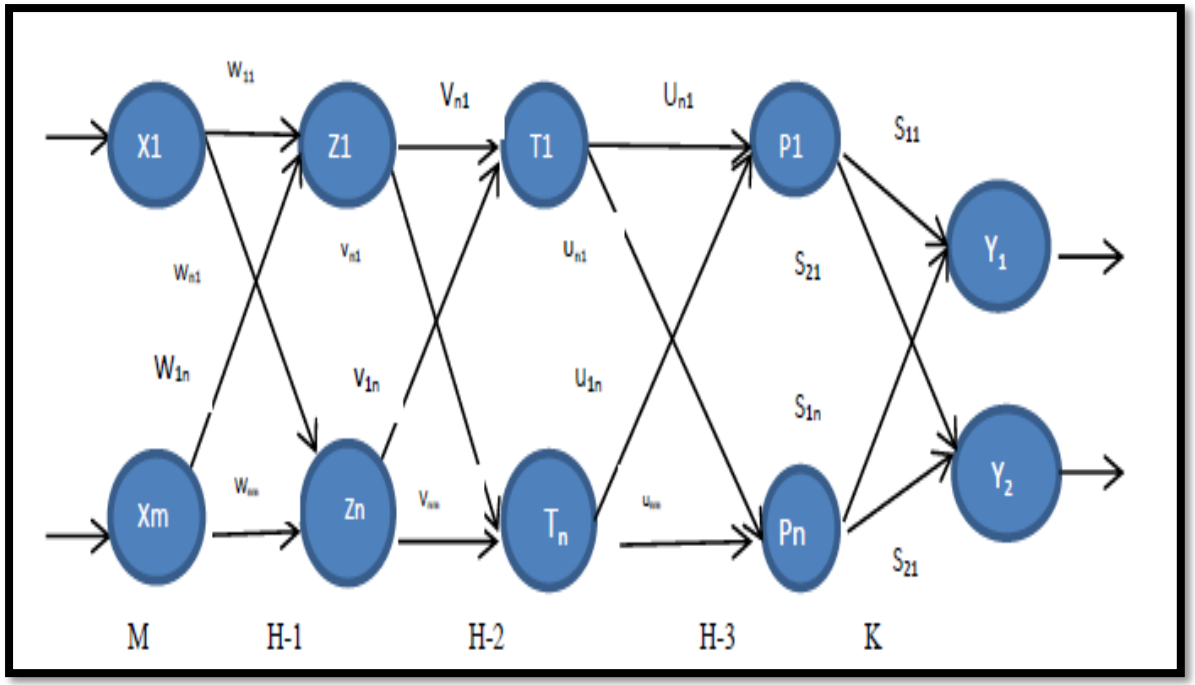
Por	JK	JB	V	H	M
0.51	0.28	0.72	0.33	0.3	0.37
0.54	0.28	0.72	0.39	0.3	0.31
0.54	0.21	0.79	0.42	0.32	0.26
0.71	0.29	0.71	0.51	0.15	0.34
0.69	0.38	0.62	0.49	0.28	0.23
0.63	0.27	0.73	0.44	0.36	0.2
0.52	0.09	0.91	0.5	0.29	0.21
0.65	0.2	0.8	0.39	0.37	0.24
0.56	0.11	0.89	0.47	0.28	0.25
0.55	0.27	0.73	0.35	0.35	0.3
0.54	0.44	0.56	0.39	0.28	0.33
0.58	0.27	0.73	0.34	0.34	0.32
0.67	0.2	0.8	0.52	0.34	0.14
0.6	0.39	0.61	0.33	0.32	0.35
0.7	0.28	0.72	0.46	0.28	0.26
0.75	0.41	0.59	0.58	0.22	0.2
0.66	0.28	0.72	0.55	0.2	0.25
0.78	0.37	0.63	0.54	0.28	0.18
0.77	0.25	0.75	0.52	0.23	0.25
0.65	0.22	0.78	0.49	0.32	0.19
0.66	0.15	0.85	0.49	0.33	0.18
0.75	0.28	0.72	0.48	0.26	0.26
0.75	0.27	0.73	0.59	0.18	0.23
0.65	0.29	0.71	0.37	0.43	0.2
0.66	0.27	0.73	0.43	0.2	0.37

2014
Seleksi Ciri: Decision Tree



Training : Neural Network , K Fold





Testing

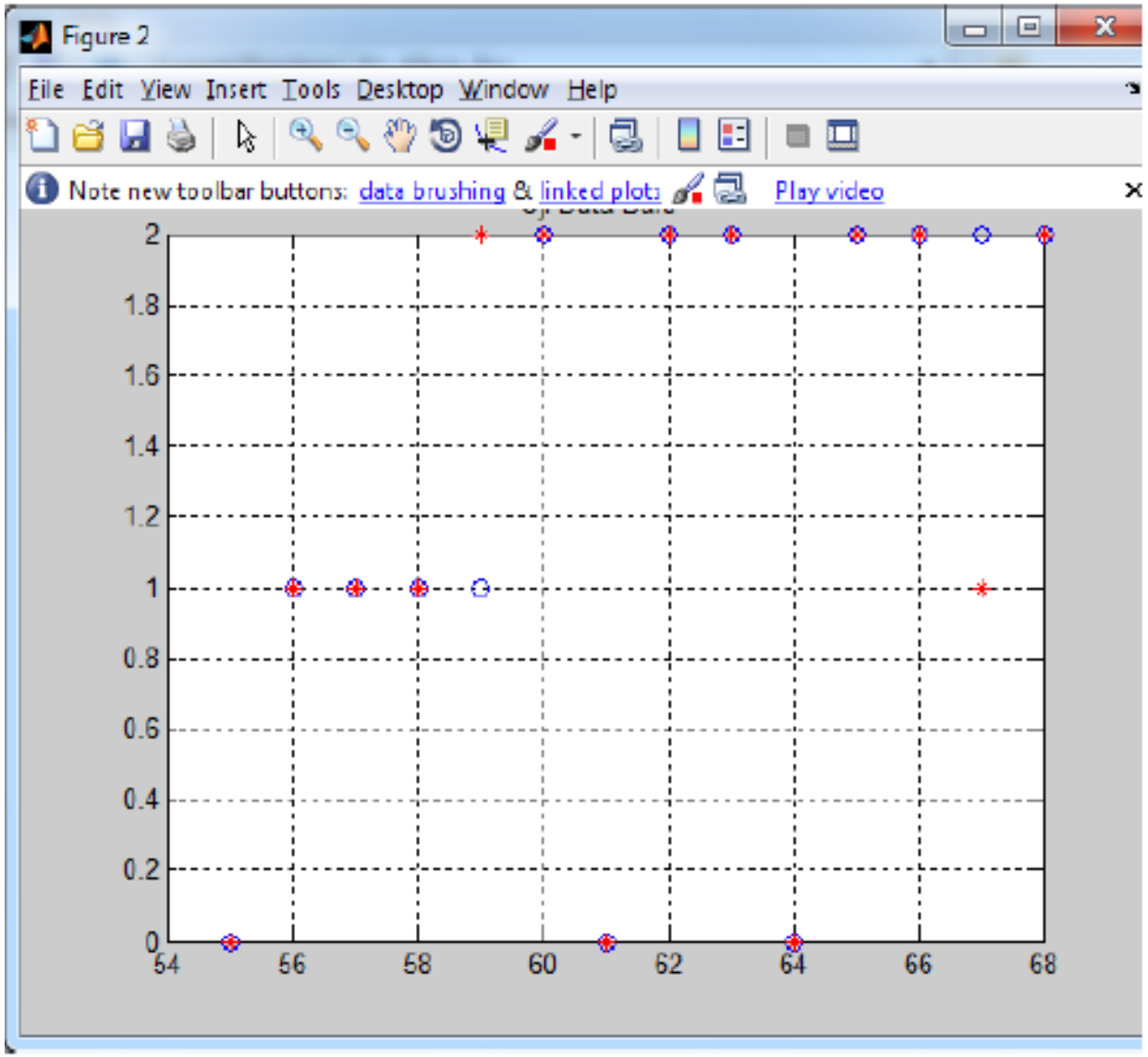


Figure 2
File Edit View Insert Tools Desktop Window Help
Note new toolbar buttons: data brushing & linked plots
Play video
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
54
56
58
60
62
64
66
68

Performansi

Matrix Confussion: **Akurasi, sensitivitas, spesifisitas**

DEXA	MODEL		
	Normal	Osteopenia	Osteoporosis
Normal	A	B	C
Osteopenia	D	E	F
Osteoporosis	G	H	I

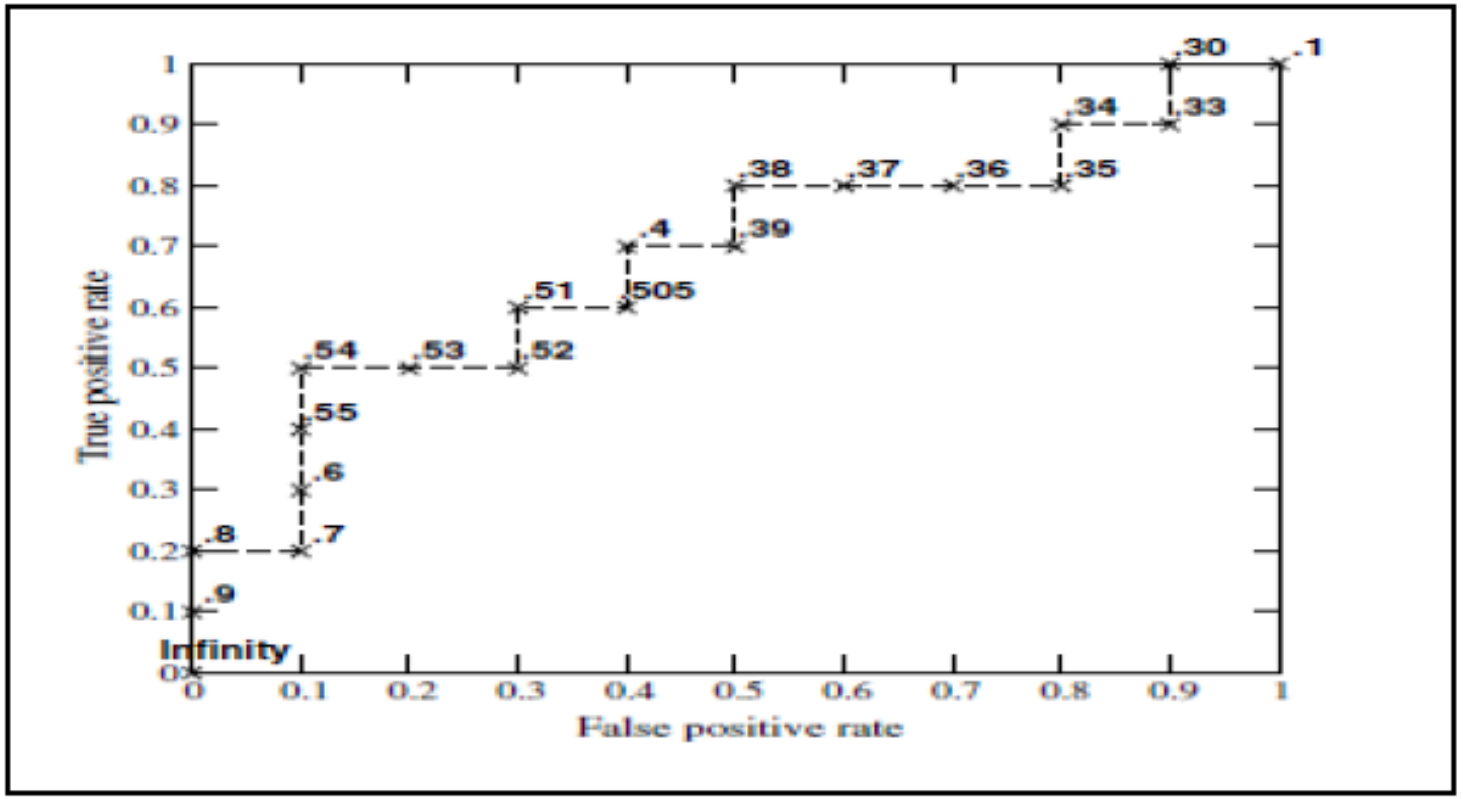
Akurasi (%)	Sensitifitas (%)		Spesifisitas (%)	
85.71%.	N	100	N	81.81
	ON	75	ON	90
	OP	85.71	OP	85.71
	Rata	86.90	Rata	85.84

Kelas	Akurasi	Spesifisitas	Sensitivitas
Normal	$\frac{A+E+I}{A+B+C+D+E+F+G+H+I}$	$\frac{E+F+H+I}{D+E+F+G+H+I}$	$\frac{A}{A+B+C}$
Osteopenia		$\frac{A+C+G+I}{A+B+C+G+H+I}$	$\frac{E}{D+E+F}$
Osteoporosis		$\frac{A+B+D+E}{A+B+C+D+E+F}$	$\frac{I}{G+H+I}$

Performansi

Receiver Operating Characteristics (ROC)

AUC=area under the curve



Tantangan (4) : “hilirisasi”

- Akurasi tinggi, spesifikasi tinggi, sensitivitas tinggi, AUC tinggi

- “tool” → membantu dokter , keputusan terakhir dokter yang berkaitan

-Selesai-