

Machine Learning: Guide to Getting Started





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Greetings!



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Sesi hari ini:

1. Apa itu Machine Learning?
2. Jenis-Jenis Masalah Machine Learning
3. Workflow Machine Learning

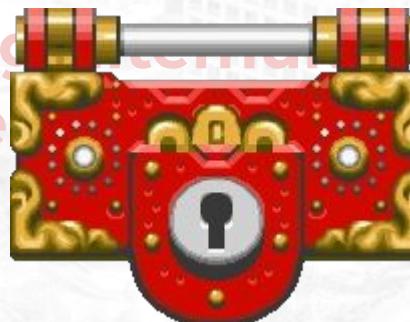
Apa itu Machine Learning (ML)?

Belajar mengajari mesin cara belajar

Machine Learning

Berikan 3 tebakan untuk lanjut ke slide berikutnya!

- + Gunakan pola yang terdapat untuk membuat keputusan mengenai klasifikasi baru



Mari mulai
dengan yang
lebih sederhana.

Apa itu Machine Learning (ML)?

*dalam konteks Machine Learning



Contoh Kasus

Data Rekap Kelulusan Murid SMP Negeri 666 Paku (Fiktif)

Presensi	Nilai Ujian Akhir	Donasi Orangtua	Lulus
90%	60	1 Milyar	YA
70%	70	0	YA
90%	60	0.5 Milyar	TIDAK
50%	100	1 Milyar	YA
100%	60	0	TIDAK
20%	10	5 Milyar	YA
80%	80	1 Milyar	YA

90%	0	10 Milyar	?
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Pertanyaan #1:
Berdasarkan data yang kalian lihat di tabel, apakah murid dengan presensi 90%, nilai ujian akhir 80, dan donasi orangtua 10 Milyar akan lulus?

Apakah syarat kelulusan SMP Negeri 666 Paku?

Data Rekap Kelulusan Murid SMP Negeri 666 Paku (Fiktif)

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50%	100	1 Milyar	YA
100%	60	0	TIDAK
20%	10	5 Milyar	YA
80%	80	1 Milyar	YA

90%	0	10 Milyar	YA
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**Syarat Kelulusan
(salah satu terpenuhi
→ lulus):**

- **Presensi > 60% &
Nilai Ujian > 60**
Atau
- **Donasi > 0.5 Milyar**

Learning

- Dari data/sekumpulan observasi yang dimiliki
- Pelajari pola/aturan yang menggambarkan bagaimana data/observasi tsb. dihasilkan
- + Gunakan pola yang ditemukan untuk membuat keputusan mengenai data/observasi baru

Machine Learning

Sebuah proses:

- **Dari data/sekumpulan observasi yang dimiliki**
- **Secara otomatis mempelajari pola/aturan yang ada dengan bermacam algoritma**
- + **Gunakan pola yang ditemukan untuk membuat keputusan mengenai data/observasi baru**

Machine Learning

2 pertanyaan:

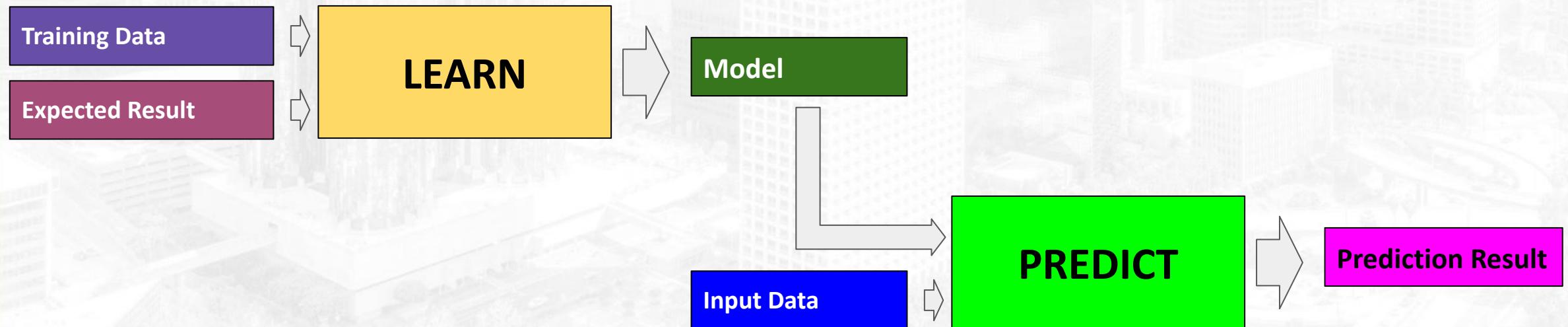
- Apakah kita dapat menangkap pola-pola/aturan yang tersimpan di dalam data?
- + Apakah pola-pola yang kita tangkap dapat diterapkan untuk data yang baru?

Conventional vs Machine Learning

Conventional Modelling

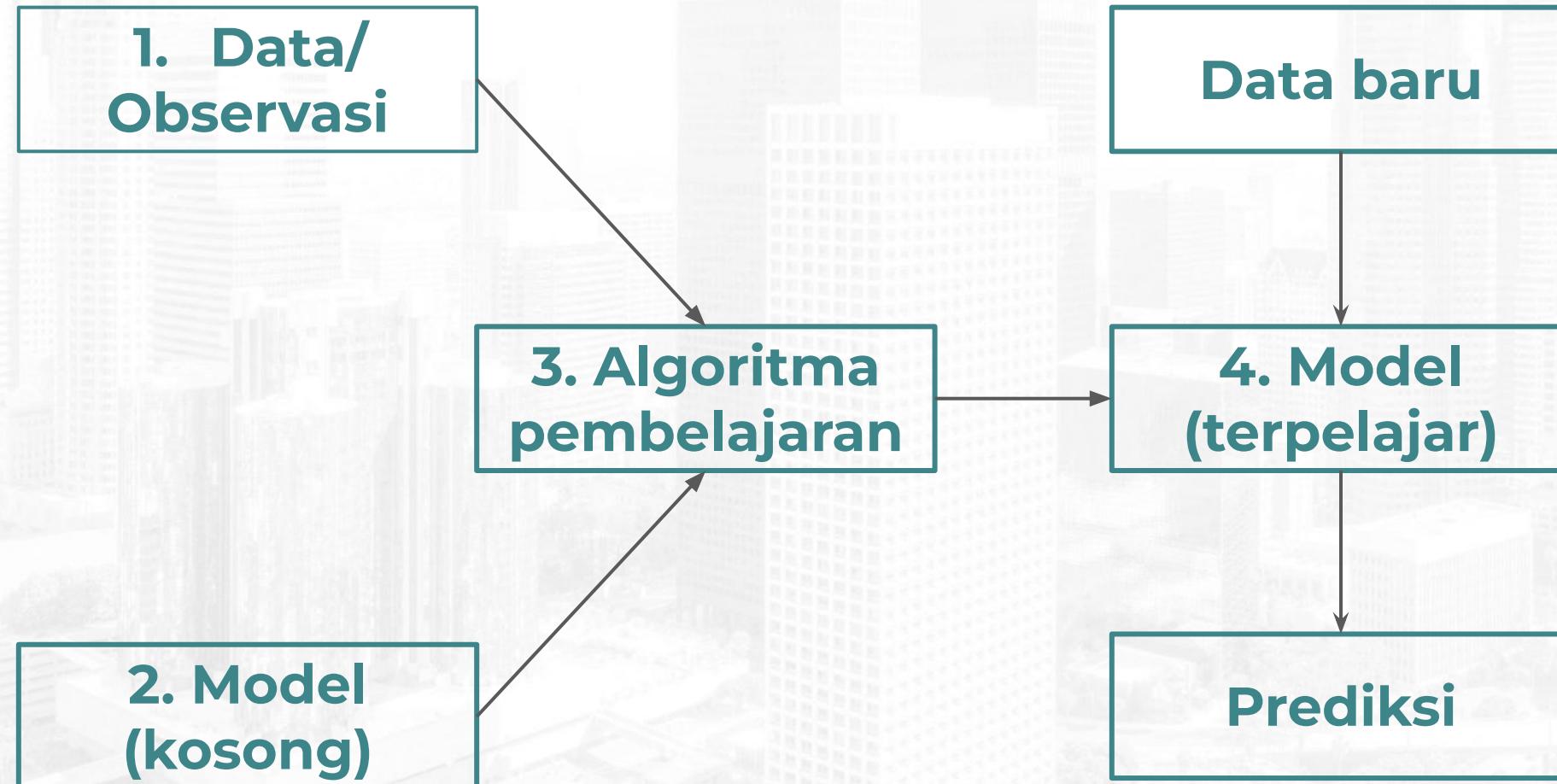


Machine Learning Modelling



Belajar ML = belajar:

1. Bagaimana cara mempersiapkan data agar dapat digunakan dalam proses pembelajaran?
2. Apa saja model yang dapat diajari untuk menemukan pola-pola/aturan dalam data?
3. Bagaimana cara mengajari model tersebut dengan data yang kita punya?
4. Bagaimana cara memastikan model yang sudah kita ajari dapat mengaplikasikan ilmunya pada data-data baru?



Perhatian:

- Mesin belajar **HANYA** dari data yang dimiliki
- Mesin **TIDAK PUNYA** pengetahuan dasar
- Pada dasarnya mesin hanya mengerti **ANGKA**

Jenis-jenis Masalah ML

spoiler: ada banyak

Jenis - jenis Machine Learning

Supervised Learning



- ❖ Tersedia data dengan target
- ❖ Tujuan: memprediksi data baru dengan benar
- ❖ Jenis: Klasifikasi dan regresi

Unsupervised Learning



- ❖ Tersedia data tanpa target
- ❖ Tujuan: menyingkap pola hubungan yang tersembunyi
- ❖ Clustering, reduksi dimensi

Reinforcement Learning



- ❖ Trial and error learning pada suatu lingkungan dengan aturan spesifik
 - ❖ Tujuan: Melatih 'agen' dalam suatu 'task' untuk memaksimalkan 'reward'
- * diluar scope Bootcamp

Supervised Learning

- Tersedia data dengan target
- Klasifikasi dan regresi

Data = Fitur + Target

No	Mahasiswa	Nilai Quiz	Nilai UTS	Nilai UAS	Nilai Akhir	Lulus
1	Budi	55	70	80	68.33	Tidak
2	Ahmad	65	75	80	73.33	Ya
3	Sandi	70	70	75	71.67	Ya
4	Robert	90	65	50	68.33	Tidak
5	Bagja	80	70	65	71.67	Ya



- **Fitur** : Data yang kita diduga berpengaruh terhadap target
- **Target** : Hal yang ingin kita prediksi menggunakan fitur-fitur baru

Note :

ada yang menyebut fitur dan target dengan istilah lain

- Istilah lain untuk fitur : predictor, variabel, dll
- Istilah lain untuk target : label, kelas, dll

Data = Fitur + Target (2)



Kucing



Kucing



Kucing

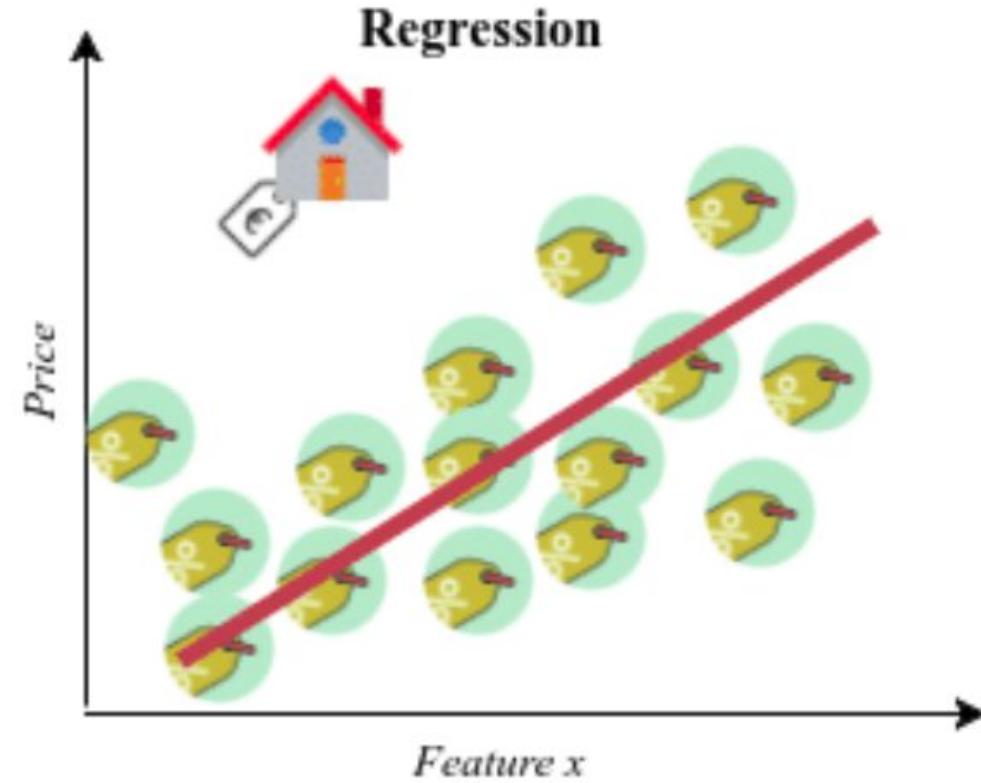
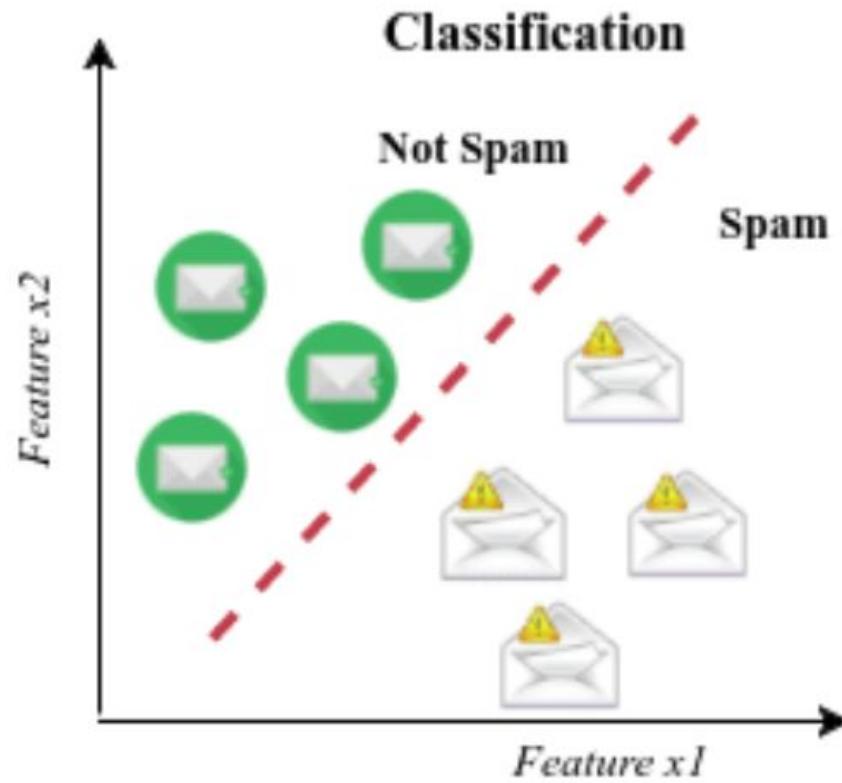


Bukan
Kucing

Fitur

Target

2 Tipe Supervised Learning



Klasifikasi

**Input
(Fitur)**

Presensi	Nilai Ujian Akhir	Donasi Orangtua
90%	60	1 Milyar
70%	70	0
90%	60	0.5 Milyar
50%	100	1 Milyar
100%	60	0
20%	10	5 Milyar
80%	80	1 Milyar



Kategori

**Output
(Target)**

Lulus
YA
YA
TIDAK
YA
TIDAK
YA
YA

Regresi

Input
(Fitur)

Luas Tanah	Luas Bangunan	Kota	Dekat Sekolah
64	60	Depok	Ya
90	70	Depok	Ya
50	36	Bogor	Tidak
100	90	Bekasi	Tidak
75	66	Bekasi	Tidak
80	65	Depok	Ya
120	100	Tangerang	Ya

Angka

Output
(Target)



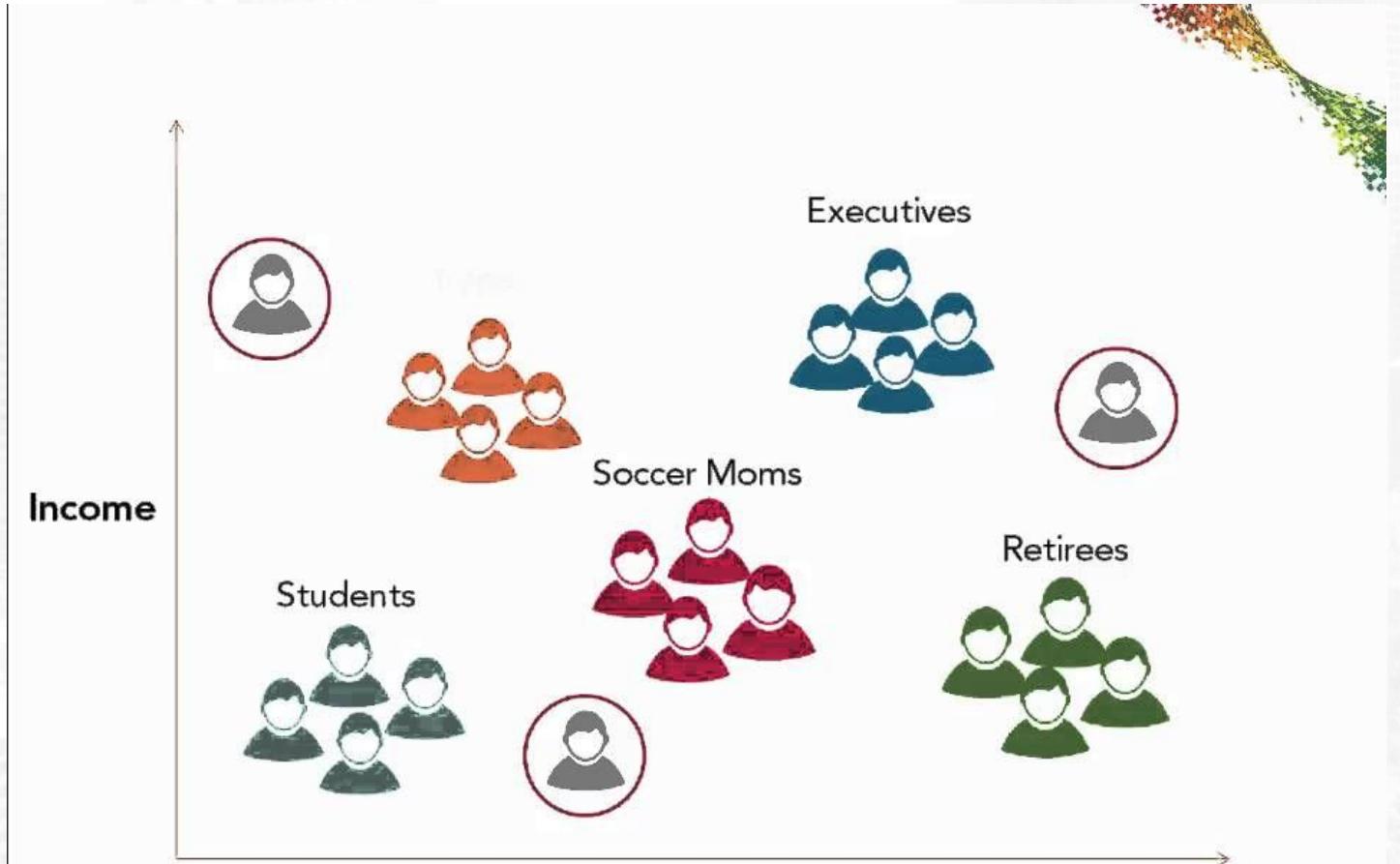
Harga Rumah

500 jt
750 jt
250 jt
978 jt
400 jt
400 jt
999 jt

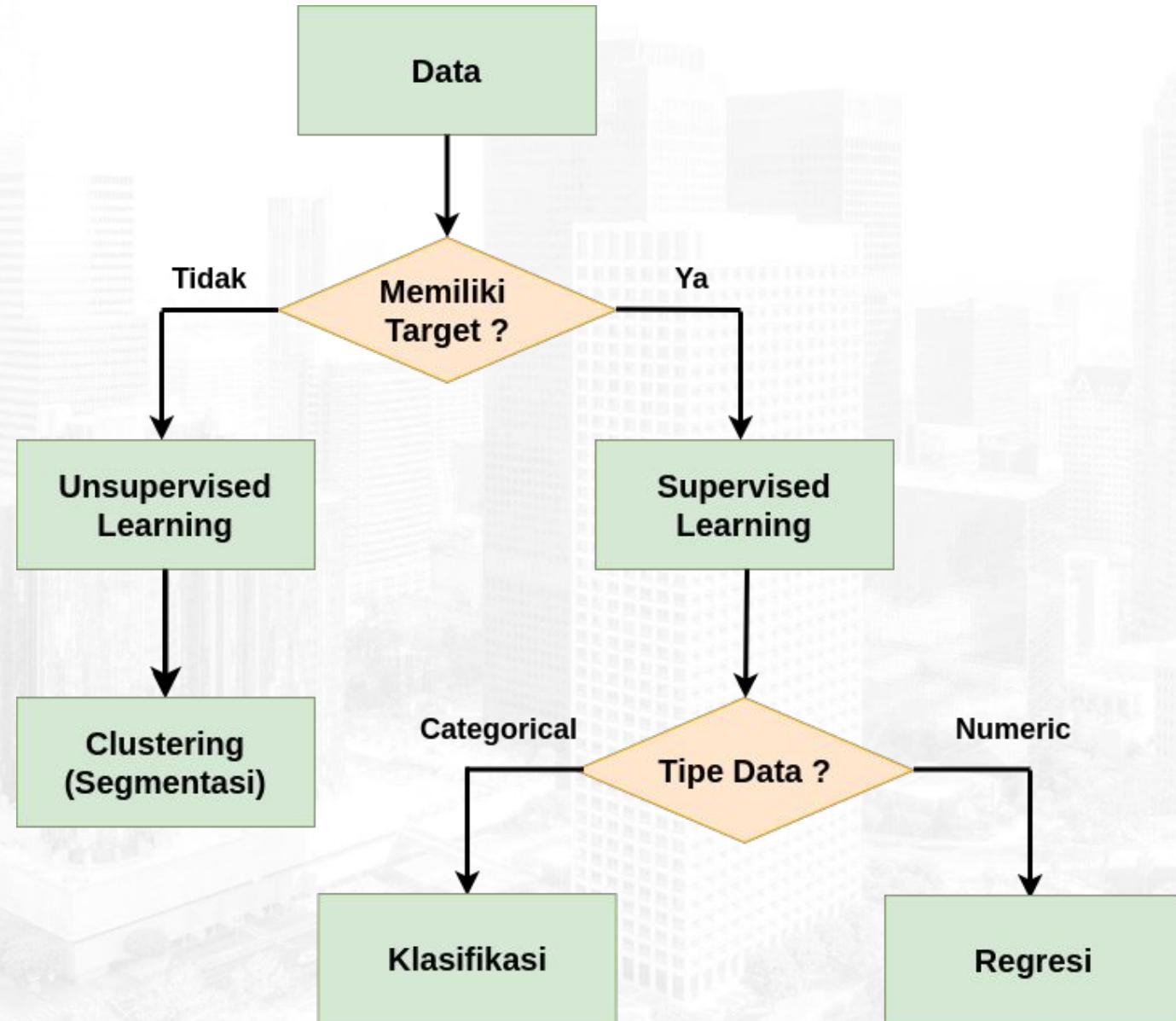
Unsupervised Learning

- Tersedia data tanpa target
- Clustering, reduksi dimensi

Clustering



Segmentasi pelanggan berdasarkan data umur & pendapatan per tahun



Reinforcement Learning

- Trial and error learning pada suatu lingkungan dengan aturan spesifik
- Tujuan: melatih ‘agen’ dalam suatu ‘task’ untuk memaksimalkan ‘reward’

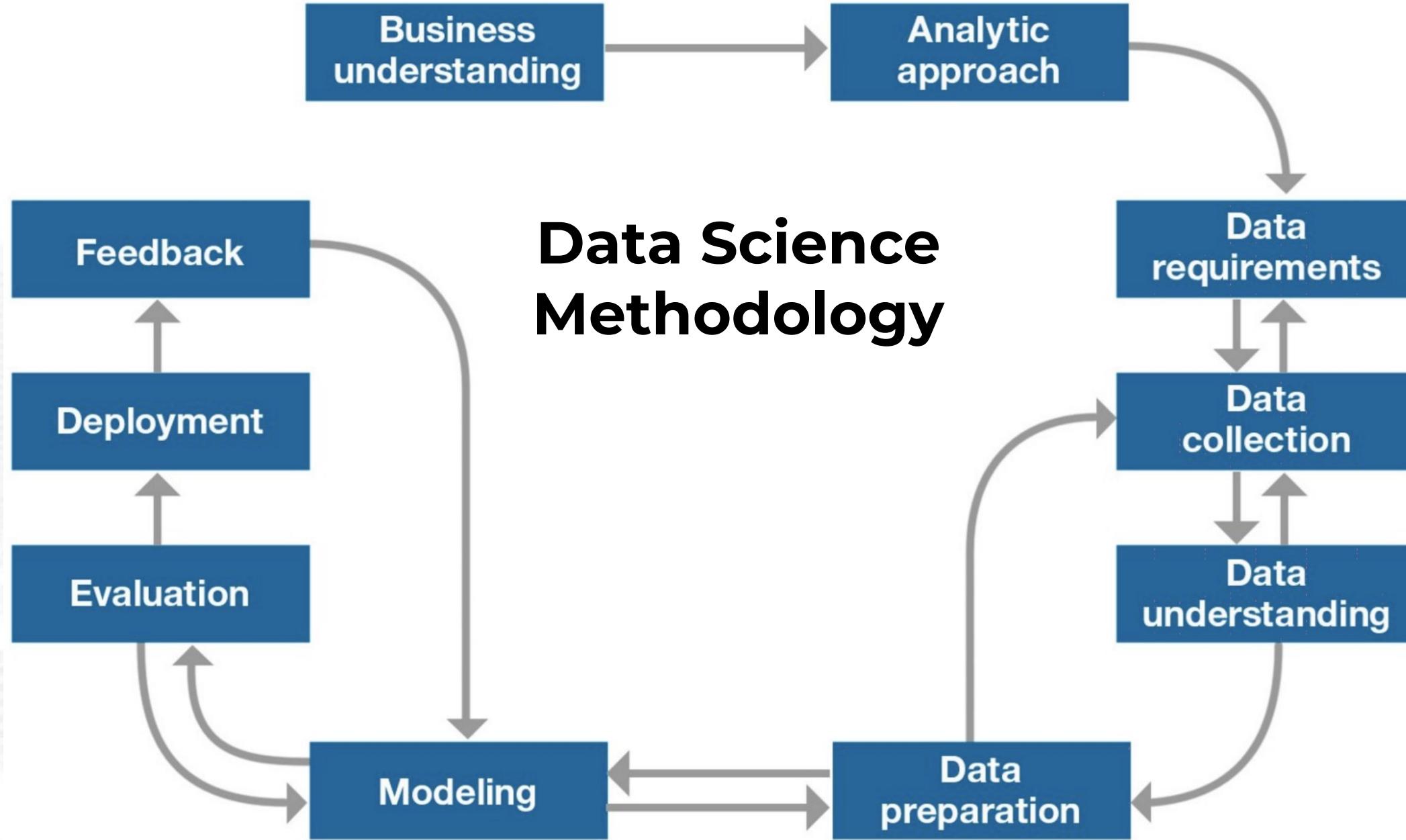
AI Go, Dota 2, etc.



Reinforcement Learning

Workflow Machine Learning

Step-by-step ML



Tahap	Masuk	Proses	Keluar
Data collection	-	<ul style="list-style-type: none"> • Survey/Labelling • ETL 	<ul style="list-style-type: none"> • Data mentah
Data understanding	<ul style="list-style-type: none"> • Data mentah 	<ul style="list-style-type: none"> • Exploratory Data Analysis 	<ul style="list-style-type: none"> • Data mentah • Insight
Data preparation	<ul style="list-style-type: none"> • Data mentah • Insight 	<ul style="list-style-type: none"> • Pre-processing • Feature processing 	<ul style="list-style-type: none"> • Data <i>training</i> • Data <i>test/validation</i>
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- **Data mentah:** semua kandidat *feature*, format apapun, kotor, ***feature + label***
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Data Collection

Example Dataset

	LoanID	Gender	Marital Status	Children	Education	Job	Salary	Loan Amount	Loan Term (days)	BI Checking	Decision
0	N2005	Male	Single	0	S1	PNS	11698000	100000	60	good	APPROVE
1	N2007	Male	Married	1	S1	Kar. Swasta	9166000	256000	60	not good	REJECT
2	N2005	Male	Single	0	S1	PNS	11698000	100000	60	good	APPROVE
3	N2013	Male	Married		D3	Kar. Swasta	5166000	240000	90	good	APPROVE
4	N2017	Male	Single	0	S2	Kar. Swasta	12000000	282000	60		APPROVE
...
609	N5957	Female	Widowed	0	S1	Kar. Swasta	5800000	142000	60	good	APPROVE
610	N5959	Male	Married	3+	S1	PNS	8212000	80000	30	good	APPROVE
611	N5967				S2	Kar. Swasta	16144000	506000	60		REJECT
612	N5969	Male	Married	2	S1	Kar. Swasta	15166000	374000	60	good	APPROVE
613	N5981	Female	Single	0	S1	Wiraswasta	9166000	266000	60	not good	REJECT

CHALLENGE

Feature apa lagi yang bisa kita tambahkan?

	LoanID	Gender	Marital Status	Children	Education	Job	Salary	Loan Amount	Loan Term (days)	BI Checking	Decision
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Data Understanding

Exploratory Data Analysis (EDA):

Proses analisis untuk memahami karakteristik data, dan hal-hal yang perlu kita lakukan agar data tersebut dapat digunakan untuk proses pembelajaran model

Tujuan:

- Memastikan sampel datanya sudah representatif dan relevan
- Mendeteksi adanya data yang bermasalah
- Menemukan pola dan insight yang bisa dimanfaatkan untuk menyusun strategi dalam modelling

Descriptive Statistics

Cek adanya data bermasalah, cek statistical summary

→ Data bermasalah nantinya perlu ditangani

Univariate Analysis

Cek distribusi tiap feature

→ Data yang nilainya timpang nantinya perlu ditangani

Multivariate Analysis

Cek keterhubungan antar-feature atau target

→ Mendeteksi feature yang berkorelasi dengan target

→ Feature yang berkorelasi sangat tinggi, bisa dipilih salah satu saja

CHALLENGE

Temukan beberapa data bermasalah yang terlihat di sampel data berikut..

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Data Preparation

Data Cleansing

- Banyak kolom kosong → **hapus**
- Atribut Gender kosong → **diisi 'Male'**
- Atribut Gender 'Perempuan' → **diisi 'Female'**
- Atribut Children kosong → **diisi 0**
- Atribut Salary kosong → **diisi rata-rata/estimasi**
- Ada data duplikat → **hapus, sisakan 1**
- ...

Formatting & Feature Engineering

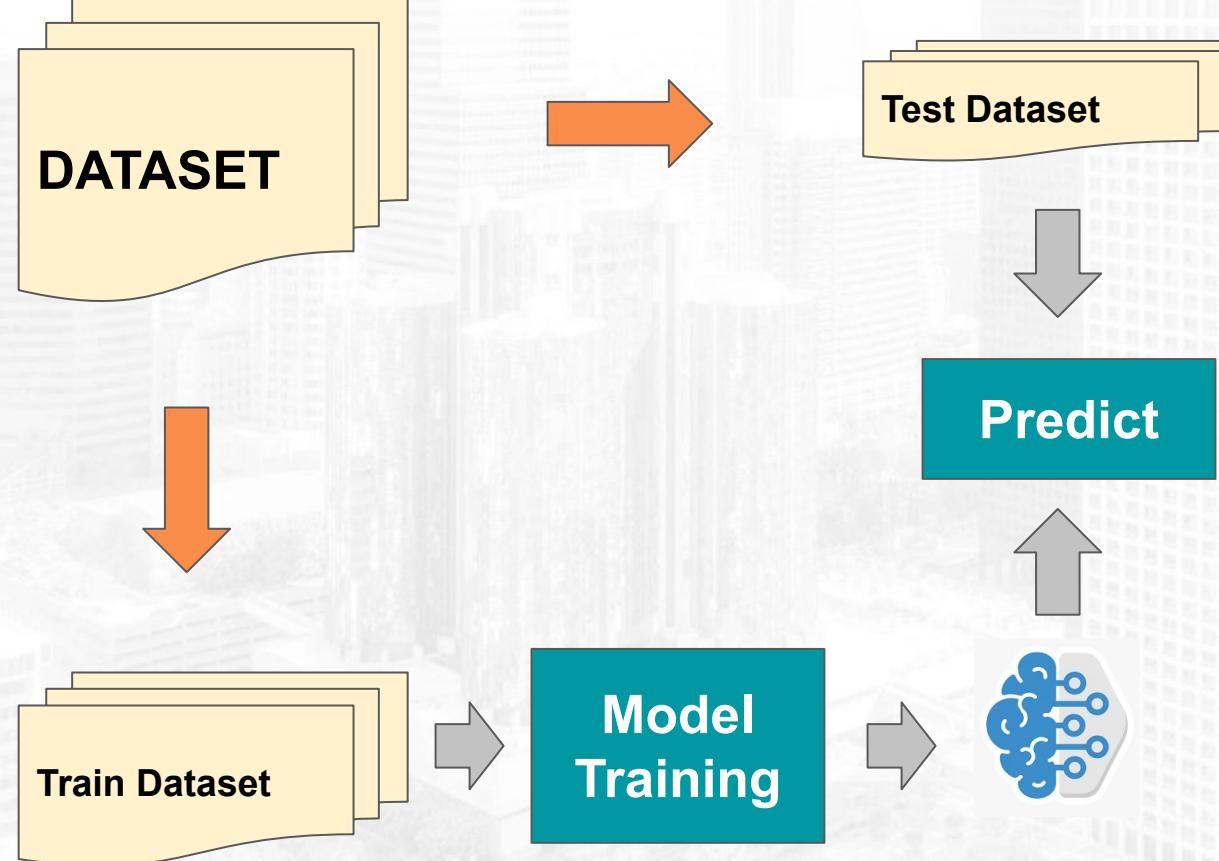
- **BI Checking** → nilai dijadikan 1 atau 0
- **Loan Term** → dari hari menjadi bulan
- **Age** → hitung dari tanggal lahir
- **# previous application** → hitung dari data historical
- **Installment** → hitung dari Pinjaman & Jangka Waktu
- **HP Number Type** (prabayar/pascabayar)

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Modelling



ML Model Algorithms:

Classification:

- Logistic Regression
- k-Nearest Neighbor
- Decision Tree
- Random Forest
- Gradient Boosting
- ...

Regression:

- Linear Regression
- Support Vector Regressor
- ...

Evaluation Metrics:

Classification:

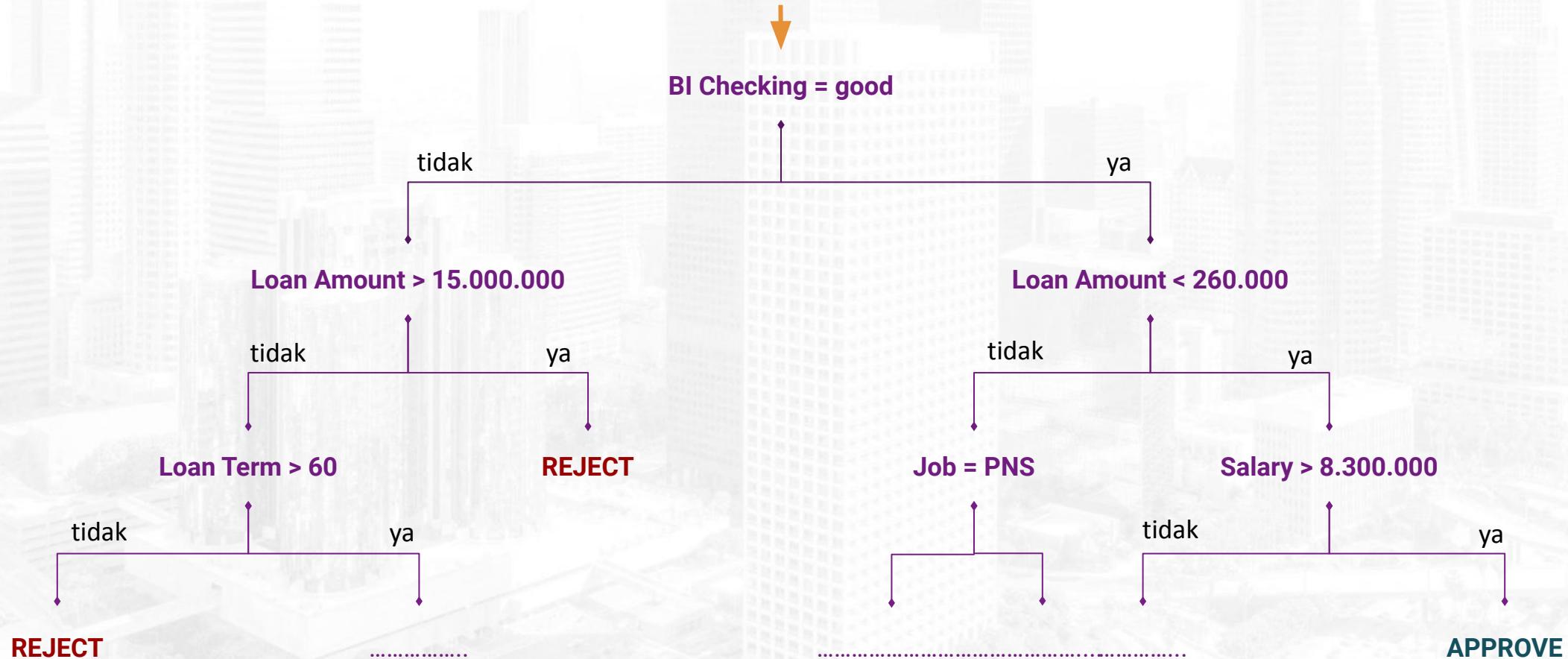
- Accuracy
- Precision
- Recall
- F1 Score
- AUC
- ...

Regression:

- RMSE
- MAE
- R2
- ...

Modelling

Contoh Model Menggunakan Algoritma Decision Tree



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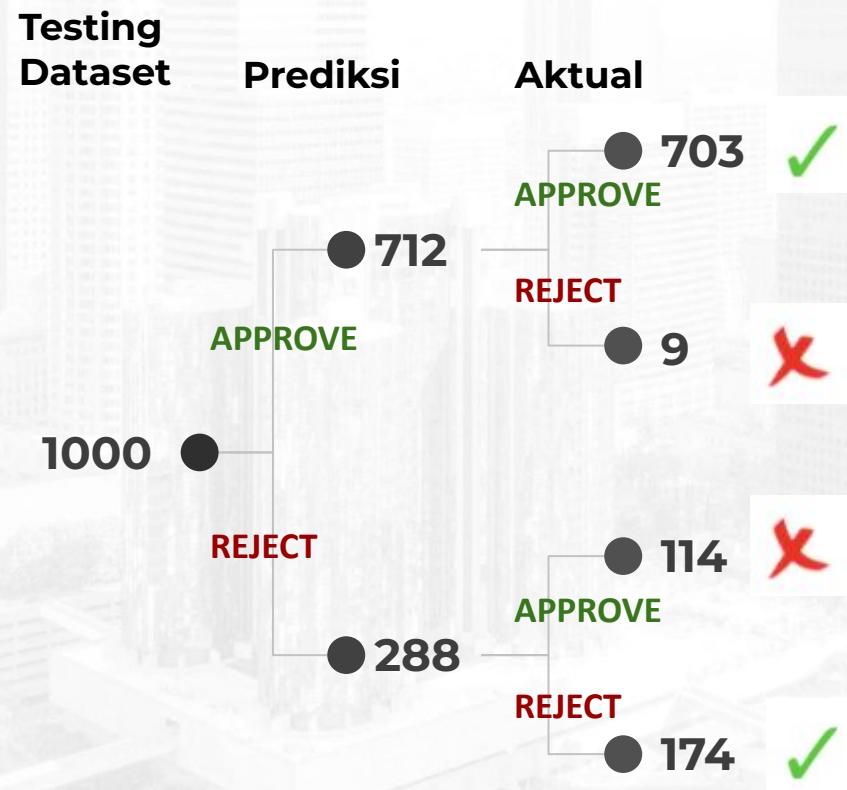
Evaluation

Testing Dataset

											Aktual	Prediksi
LoanID	Gender	Marriage Status	Children	Education	Job	Salary	Loan Amount	Loan Term (days)	BI Checking	Decision	Prediction	
7600	N3399	Male	Single	0	S1	Kar. Swasta	5205900	118000	60	good	APPROVE	APPROVE
18673	N3317	Male	Single	0	S1	Kar. Swasta	8101800	152000	60	good	APPROVE	APPROVE
13807	N3693	Female	Single	3+	S1	Kar. Swasta	6474300	510000	60	good	APPROVE	REJECT
11844	N2995	Male	Married	2	S1	Kar. Swasta	10084000	370000	60	good	REJECT	APPROVE
37996	N4697	Male	Married	0	S1	PNS	12240900	276000	60	good	APPROVE	APPROVE
...
2823	N4321	Male	Married	3+	S1	Kar. Swasta	10850700	400000	60	good	APPROVE	APPROVE
16895	N3743	Female	Single	0	S1	Kar. Swasta	15120000	240000	60	good	APPROVE	APPROVE
8375	N4377	Male	Single	0	S1	Kar. Swasta	10248000	248000	0	not good	REJECT	REJECT
10612	N2995	Male	Married	2	S1	Kar. Swasta	10084000	370000	60	good	REJECT	APPROVE
17369	N2861	Female	Single	0	S1	PNS	8748600	88000	60	good	APPROVE	APPROVE

1000 rows × 12 columns

Evaluation



Confusion Matrix

		Prediksi	
		APPROVE	REJECT
Aktual	APPROVE	703	114
	REJECT	9	174

Accuracy = (703+174)/1000 = **87.7%**

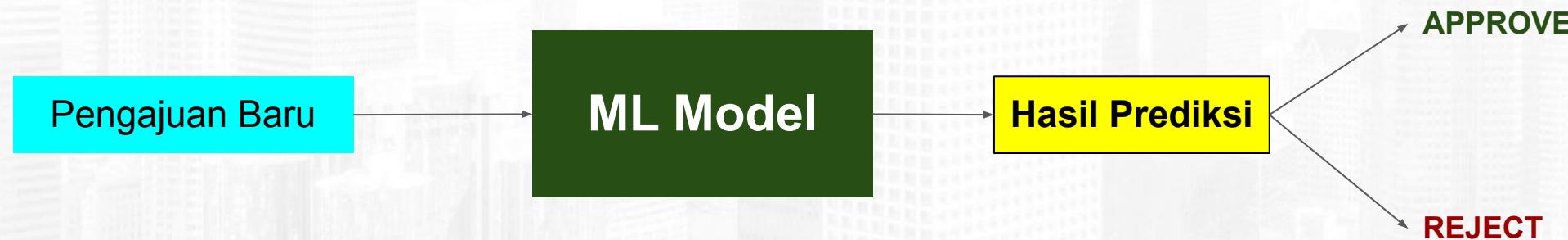
Precision = 703/(703+9) = **98.7%**

$$\text{Recall} = 174/(174+9) = \mathbf{95.1\%}$$

Tahap	Masuk	Proses	Keluar
Data collection	-	<ul style="list-style-type: none"> • Survey/Labelling • ETL 	<ul style="list-style-type: none"> • Data mentah
Data understanding	<ul style="list-style-type: none"> • Data mentah 	<ul style="list-style-type: none"> • Exploratory Data Analysis 	<ul style="list-style-type: none"> • Data mentah • Insight
Data preparation	<ul style="list-style-type: none"> • Data mentah • Insight 	<ul style="list-style-type: none"> • Pre-processing • Feature processing 	<ul style="list-style-type: none"> • Data <i>training</i> • Data <i>test/validation</i>
Modelling	<ul style="list-style-type: none"> • Data <i>training</i> 	<ul style="list-style-type: none"> • Model training • Hyperparameter tuning 	<ul style="list-style-type: none"> • ML Model
Evaluation	<ul style="list-style-type: none"> • Data <i>test/validation</i> 	<ul style="list-style-type: none"> • Validation 	<ul style="list-style-type: none"> • Performance measure
Deployment	<ul style="list-style-type: none"> • Data baru 	<ul style="list-style-type: none"> • Prediction 	<ul style="list-style-type: none"> • Prediksi

- **Data mentah:** semua kandidat *feature*, format apapun, kotor, ***feature + label***
- **Data training:** *feature* terpilih, format sesuai algoritma, ***feature + label***
- **Data test/validation:** *feature* terpilih, format sesuai algoritma, ***feature + label***
- **Data baru:** *feature* terpilih, format sesuai algoritma, ***feature tanpa label***

Deployment





Thank You



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