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Prediksi Jumlah Kasus COVID-19 di Indonesia menggunakan Kecerdasan Buatan

Lab Sistem Cerdas
Departemen Ilmu Komputer dan Elektronika
Fakultas Matematika dan Ilmu Pengetahuan Alam
Universitas Gadjah Mada

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PENDAHULUAN

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Prediksi Jumlah Kasus COVID-19

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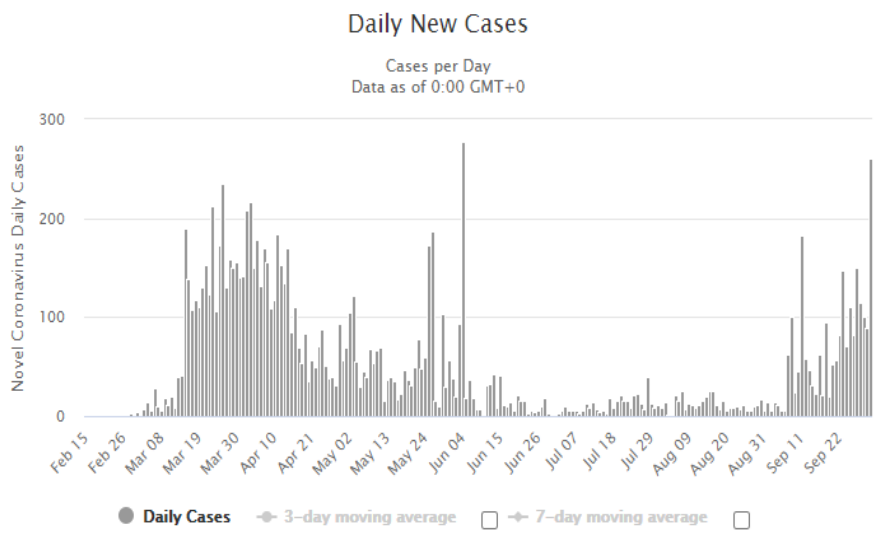
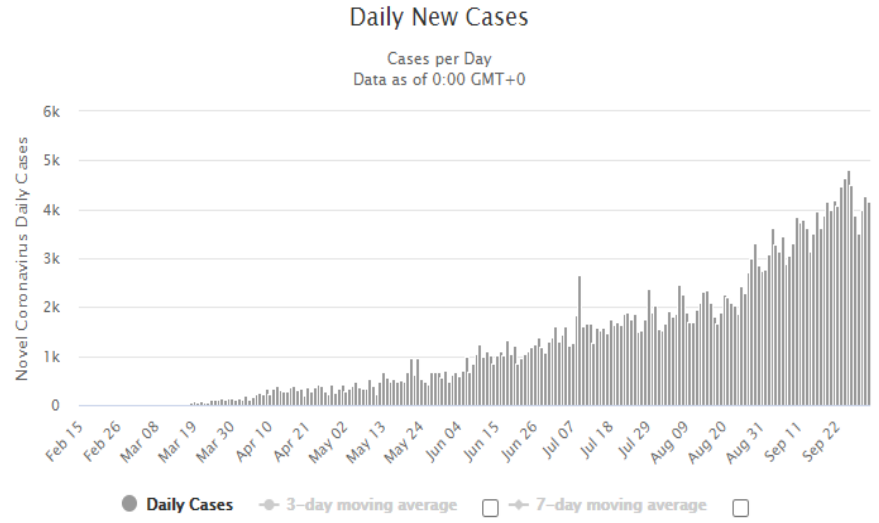
- Lab Sistem Cerdas berkolaborasi dengan Prof. Yap Bee Wah (UiTM, Malaysia)
- Jumlah Kasus Covid-19 (total) di Malaysia dan Indonesia

Daily New Cases in Malaysia



Daily New Cases in Indonesia



Sumber: https://www.worldometers.info/coronavirus

Prediksi Jumlah Kasus COVID-19

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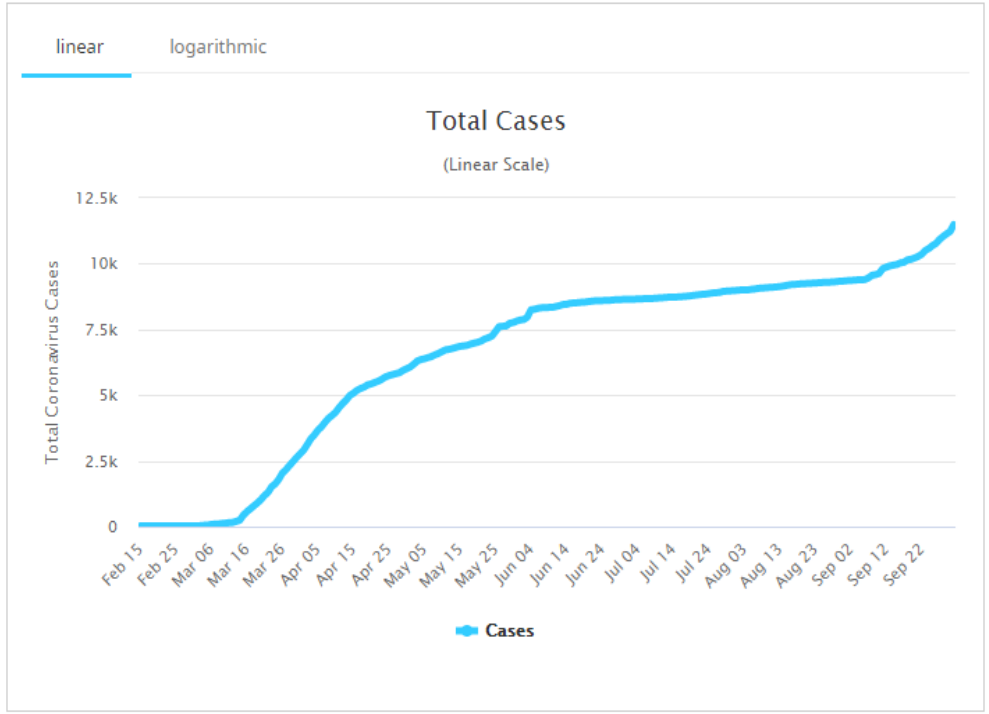
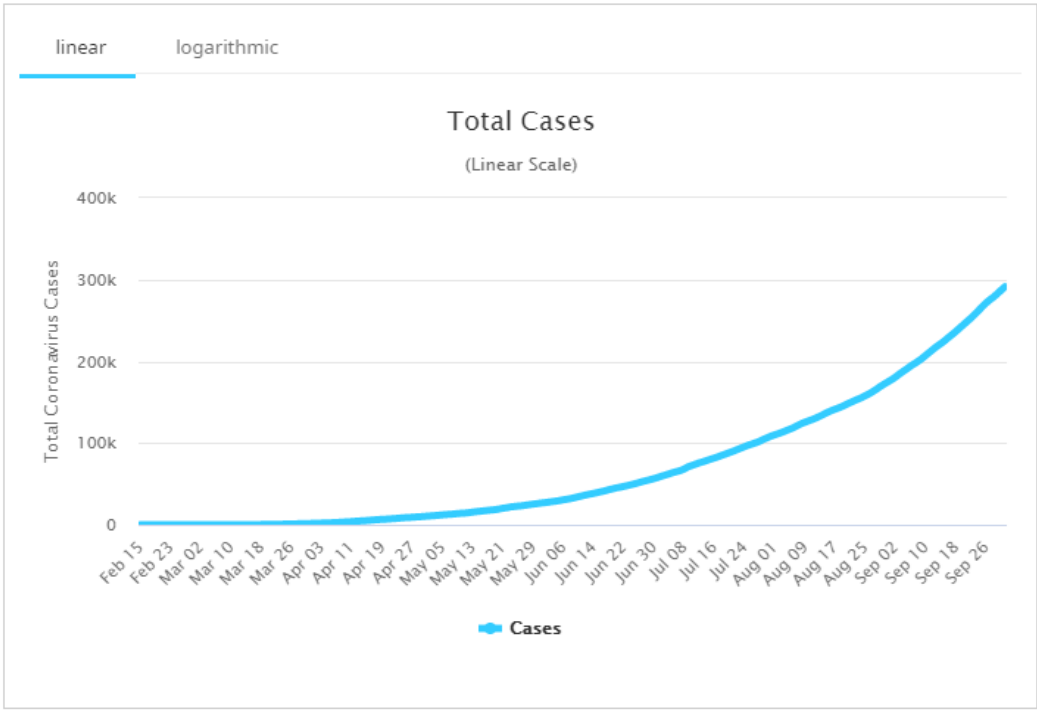
Total Coronavirus Cases in Malaysia



Total Coronavirus Cases in Indonesia



Sumber: https://www.worldometers.info/coronavirus

Based on Mathematical Model and Epidemiology

PLOS ONE

RESEARCH ARTICLE

Forecasting the novel coronavirus COVID-19

Fotios Petropoulos[1]*, **Spyros Makridakis**[2]

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Abstract

What will be the global impact of the novel coronavirus (COVID-19)? Answering this question requires accurate forecasting the spread of confirmed cases as well as analysis of the number of deaths and recoveries. Forecasting, however, requires ample historical data. At the same time, no prediction is certain as the future rarely repeats itself in the same way as the past. Moreover, forecasts are influenced by the reliability of the data, vested interests, and what variables are being predicted. Also, psychological factors play a significant role in how people perceive and react to the danger from the disease and the fear that it may affect them personally. This paper introduces an objective approach to predicting the continuation of the COVID-19 using a simple, but powerful method to do so. Assuming that the data usec is reliable and that the future will continue to follow the past pattern of the disease, our forecasts suggest a continuing increase in the confirmed COVID-19 cases with sizable associated uncertainty. The risks are far from symmetric as underestimating its spread like a pandemic and not doing enough to contain it is much more severe than overspending and being over careful when it will not be needed. This paper describes the timeline of a live fore casting exercise with massive potential implications for planning and decision making and provides objective forecasts for the confirmed cases of COVID-19.

OPEN ACCESS

Citation: Petropoulos F, Makridakis S (2020) Forecasting the novel coronavirus COVID-19. PLoS ONE 15(3): e0231236. https://doi.org/10.1371/journal.pone.0231236

Editor: Lidia Adriana Braunstein, Universidad Nacional de Mar del Plata, ARGENTINA

biology

MDPI

Article

Understanding Unreported Cases in the COVID-19 Epidemic Outbreak in Wuhan, China, and the Importance of Major Public Health Interventions

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check for updates

Abstract: We develop a mathematical model to provide epidemic predictions for the COVID-19 epidemic in Wuhan, China. We use reported case data up to 31 January 2020 from the Chinese Center for Disease Control and Prevention and the Wuhan Municipal Health Commission to parameterize the model. From the parameterized model, we identify the number of unreported cases. We then use the model to project the epidemic forward with varying levels of public health interventions. The model predictions emphasize the importance of major public health interventions in controlling COVID-19 epidemics..

Keywords: corona virus; reported and unreported cases; isolation; quarantine; public closings; epidemic mathematical model

PLOS ONE

RESEARCH ARTICLE

Data-based analysis, modelling and forecasting of the COVID-19 outbreak

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OPEN ACCESS

Citation: Anastassopoulou C, Russo L, Tsakris A, Siettos C (2020) Data-based analysis, modelling and forecasting of the COVID-19 outbreak. PLoS ONE 15(3): e0230405. https://doi.org/10.1371/journal.pone.0230405

Editor: Sreekumar Othumpangat, Center for Disease control and Prevention, UNITED STATES

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Accepted: March 1, 2020

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Peer Review History: PLOS recognizes the

Abstract

Since the first suspected case of coronavirus disease-2019 (COVID-19) on December 1st, 2019, in Wuhan, Hubei Province, China, a total of 40,235 confirmed cases and 909 deaths have been reported in China up to February 10, 2020, evoking fear locally and internationally. Here, based on the publicly available epidemiological data for Hubei, China from January 11 to February 10, 2020, we provide estimates of the main epidemiological parameters. In particular, we provide an estimation of the case fatality and case recovery ratios, along with their 90% confidence intervals as the outbreak evolves. On the basis of a Susceptible-Infectious-Recovered-Dead (SIDR) model, we provide estimations of the basic reproduction number (R_0), and the per day infection mortality and recovery rates. By calibrating the parameters of the SIRD model to the reported data, we also attempt to forecast the evolution of the outbreak at the epicenter three weeks ahead, i.e. until February 29. As the number of infected individuals, especially of those with asymptomatic or mild courses, is suspected to be much higher than the official numbers, which can be considered only as a subset of the actual numbers of infected and recovered cases in the total population, we have repeated the calculations under a second scenario that considers twenty times the number of confirmed infected cases and forty times the number of recovered, leaving the number of deaths unchanged. Based on the reported data, the expected value of R_0 as computed considering

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DATA COVID-19 DI INDONESIA

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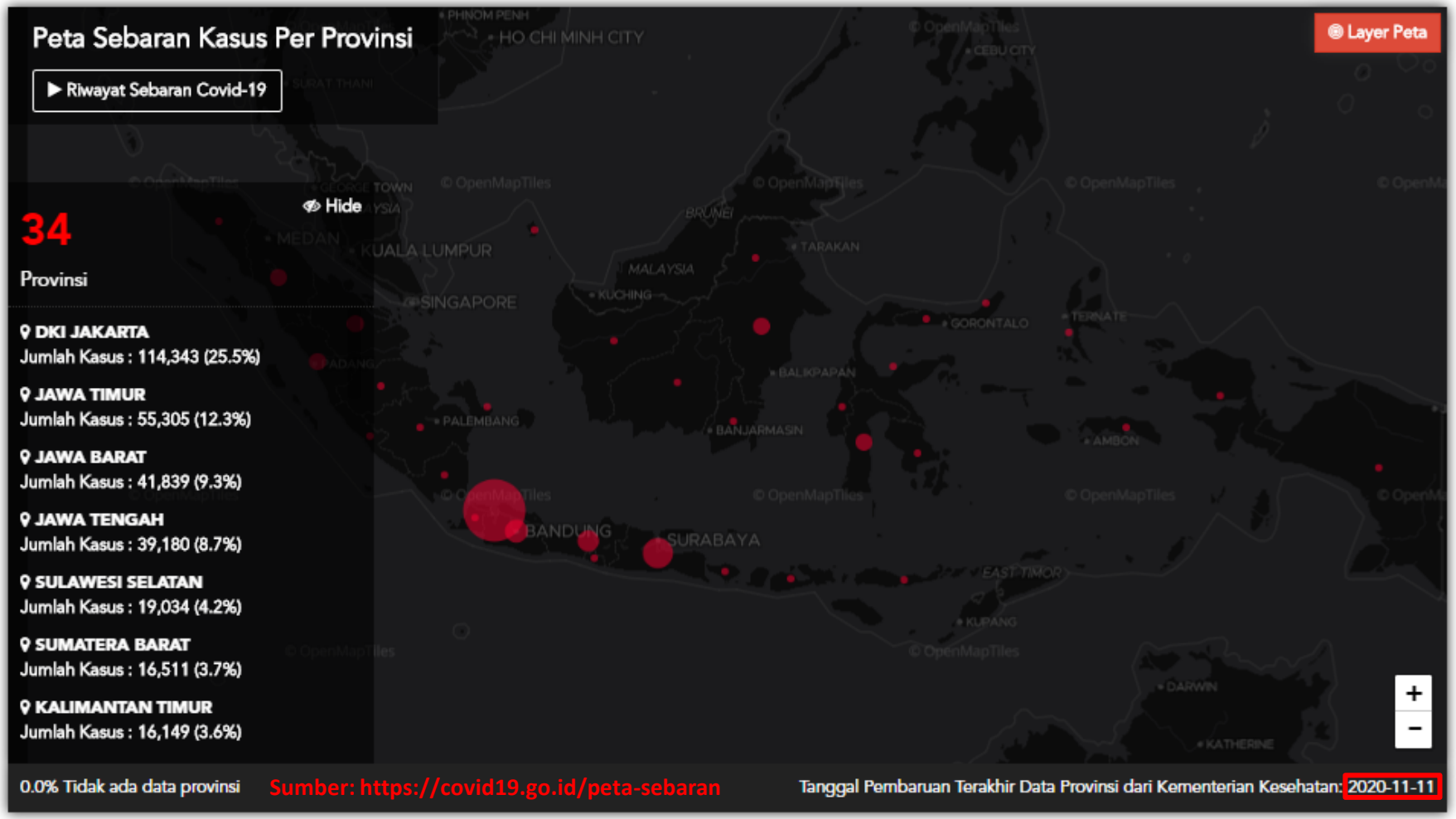
Kasus COVID-19 di Indonesia (Update: 12/11/2020)

452,291	55,274	382,084	14,933
TERKONFIRMASI	KASUS AKTIF	SEMBUH	MENINGGAL
+4,173 Kasus	12.2% dari Terkonfirmasi	84.5% dari Terkonfirmasi	3.3% dari Terkonfirmasi

Suspek	56,868	Probable	-



Perkembangan Kasus COVID-19 Harian di Tingkat Nasional (Update: 12/11/2020)

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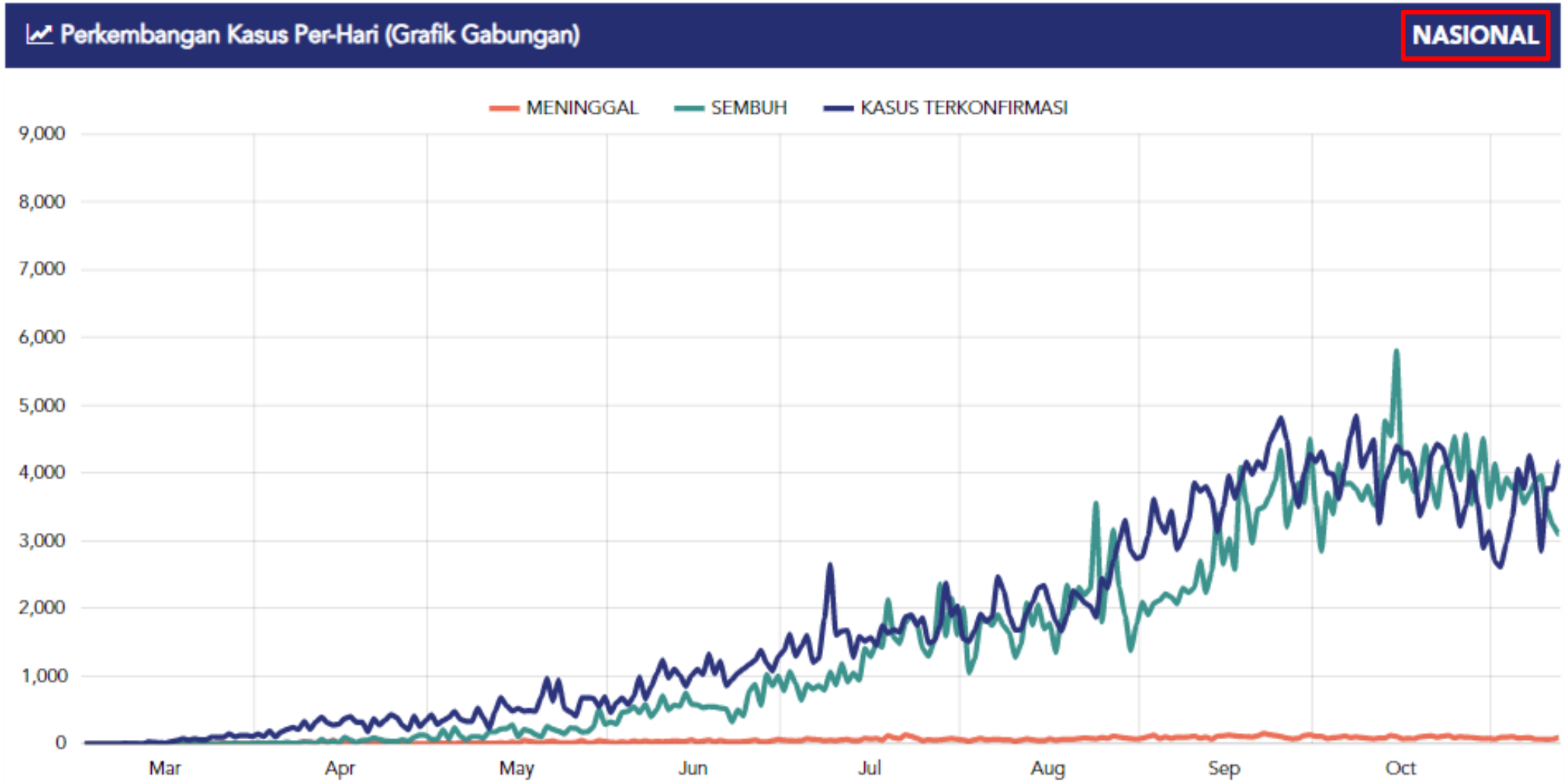
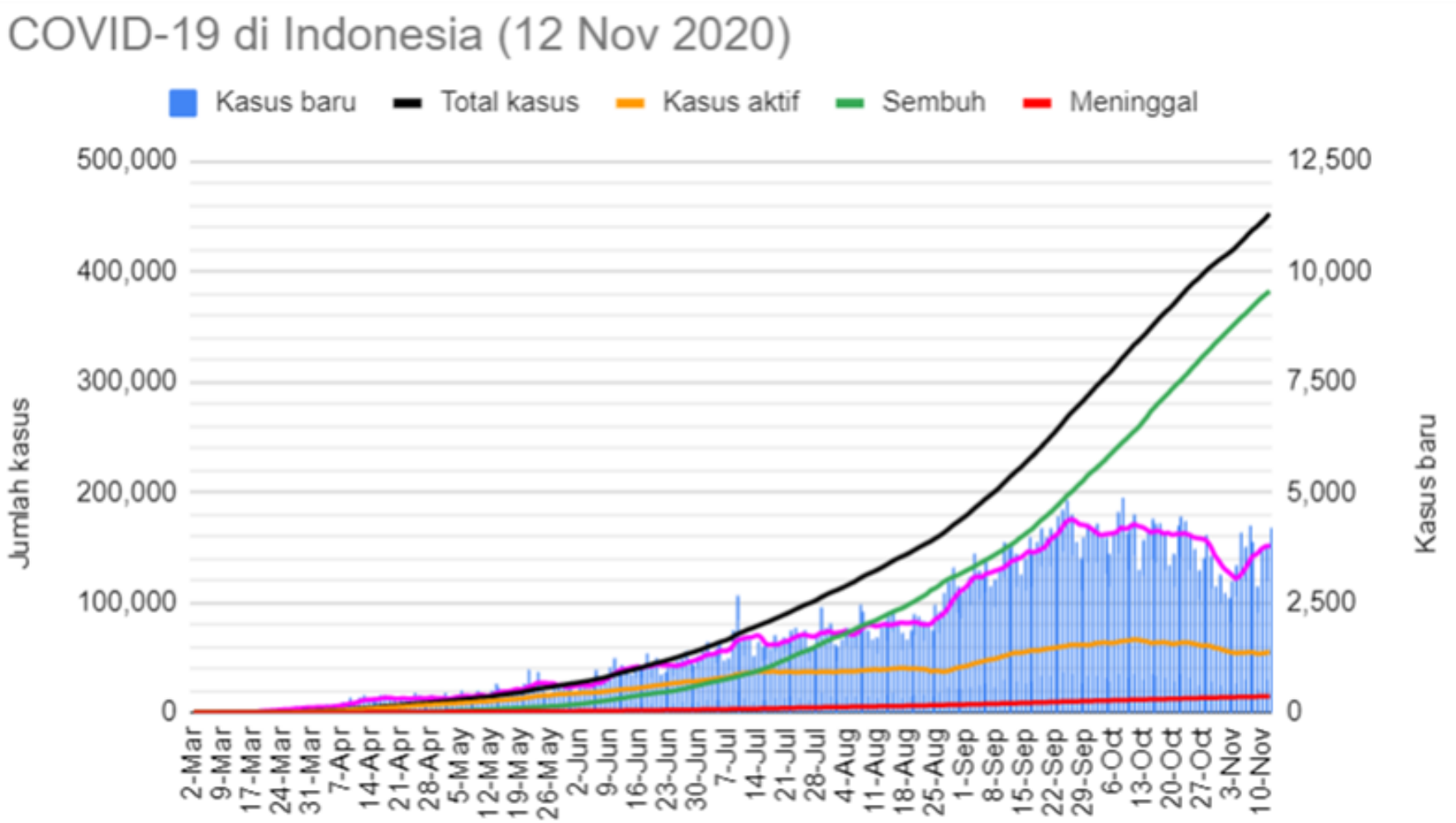


Sumber: https://covid19.go.id/peta-sebaran

Kasus Kumulatif Harian COVID-19 di Tingkat Nasional (Update: 12/11/2020)



Sumber: @kawalcovid https://docs.google.com/spreadsheets/d/1ma1T9hWbec1pXlwZ89WakRk-OfVUQZsOCFl4FwZxzVw/edit#gid=387345074

Analisis Data: Persentase Kasus Aktif di Tingkat Nasional (Update: 8/11/2020)

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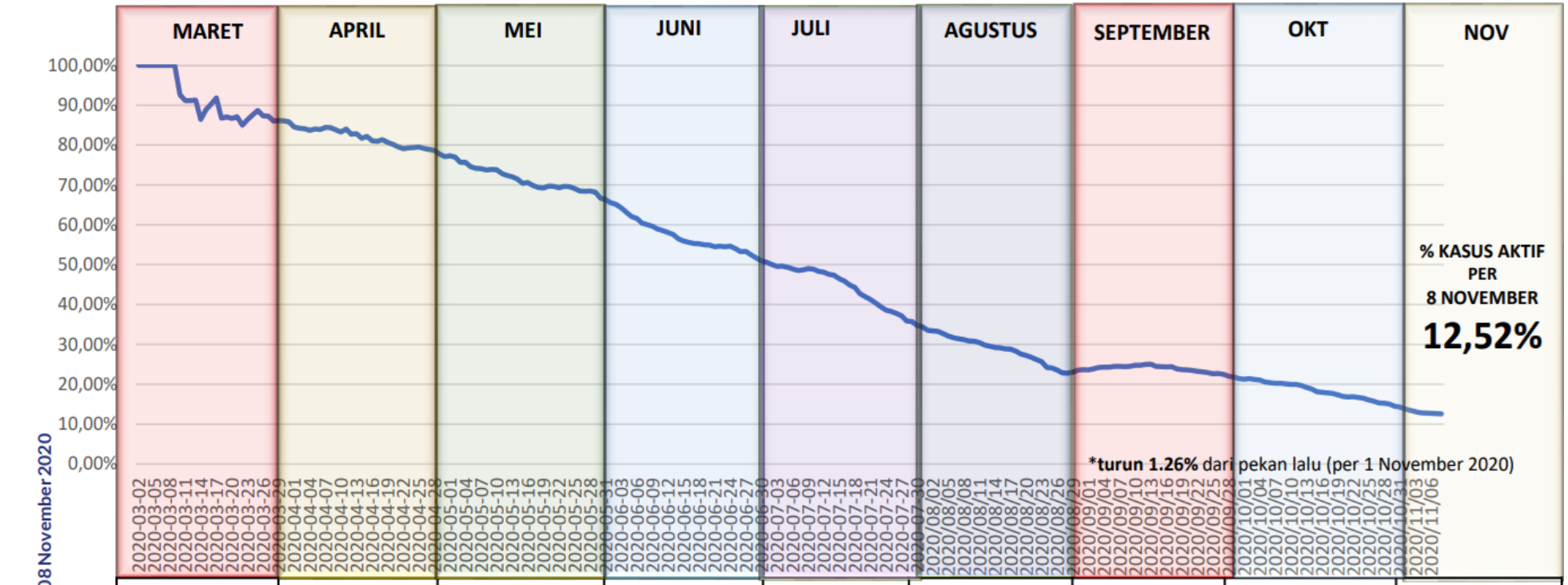

Min = 85.02%	Min = 77.13%	Min = 66.30%	Min = 50.91%	Min = 34.45%	Min = 22.74%	Min = 21.37%	Min = 17.69%	Min = 12.52%
Max = 100%	Max = 84.50%	Max = 77.34%	Max = 65.56%	Max = 50.62%	Max = 33.50%	Max= 25.02%	Max= 21.38%	Max= 13.43%
Rata2= **91.26%**	Rata2 = **81.57%**	Rata2= **71.35%**	Rata2= **57.25%**	Rata2= **44.02%**	Rata2= **28.26%**	Rata2= **23.74%**	Rata2= **19.76%**	Rata2= **12.85%**
Med=88.81%	Med= 81.52%	Med= 70.42%	Med= 55.76%	Med = 45.86%	Med= 28.88%	Med = 24.02%	Med = 20.05%	Med = 12.75%

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Sumber: Satuan Tugas Penanganan Kasus COVID-19
https://covid19.go.id/p/berita/analisis-data-covid-19-indonesia-update-08-november-2020

Analisis Data: Persentase Kematian dari Kasus Positif di Tingkat Nasional (Update: 8/11/2020)

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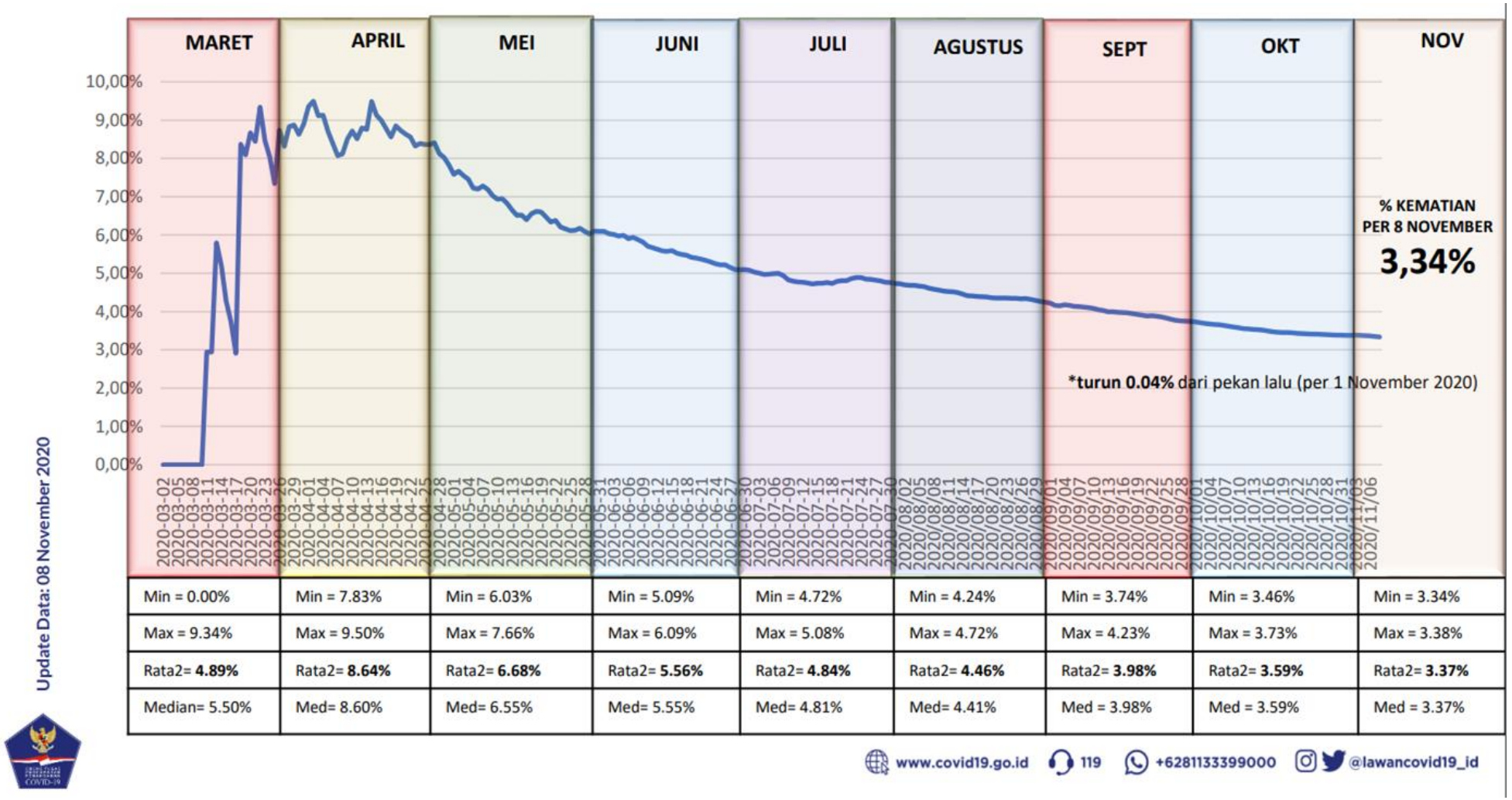

MARET	APRIL	MEI	JUNI	JULI	AGUSTUS	SEPT	OKT	NOV
Min = 0.00%	Min = 7.83%	Min = 6.03%	Min = 5.09%	Min = 4.72%	Min = 4.24%	Min = 3.74%	Min = 3.46%	Min = 3.34%
Max = 9.34%	Max = 9.50%	Max = 7.66%	Max = 6.09%	Max = 5.08%	Max = 4.72%	Max = 4.23%	Max = 3.73%	Max = 3.38%
Rata2= **4.89%**	Rata2= **8.64%**	Rata2= **6.68%**	Rata2= **5.56%**	Rata2= **4.84%**	Rata2= **4.46%**	Rata2= **3.98%**	Rata2= **3.59%**	Rata2= **3.37%**
Median= 5.50%	Med= 8.60%	Med= 6.55%	Med= 5.55%	Med= 4.81%	Med= 4.41%	Med = 3.98%	Med = 3.59%	Med = 3.37%

Sumber: Satuan Tugas Penanganan Kasus COVID-19
https://covid19.go.id/p/berita/analisis-data-covid-19-indonesia-update-08-november-2020

Analisis Data: Persentase Kesembuhan dari Kasus Positif di Tingkat Nasional (Update: 8/11/2020)

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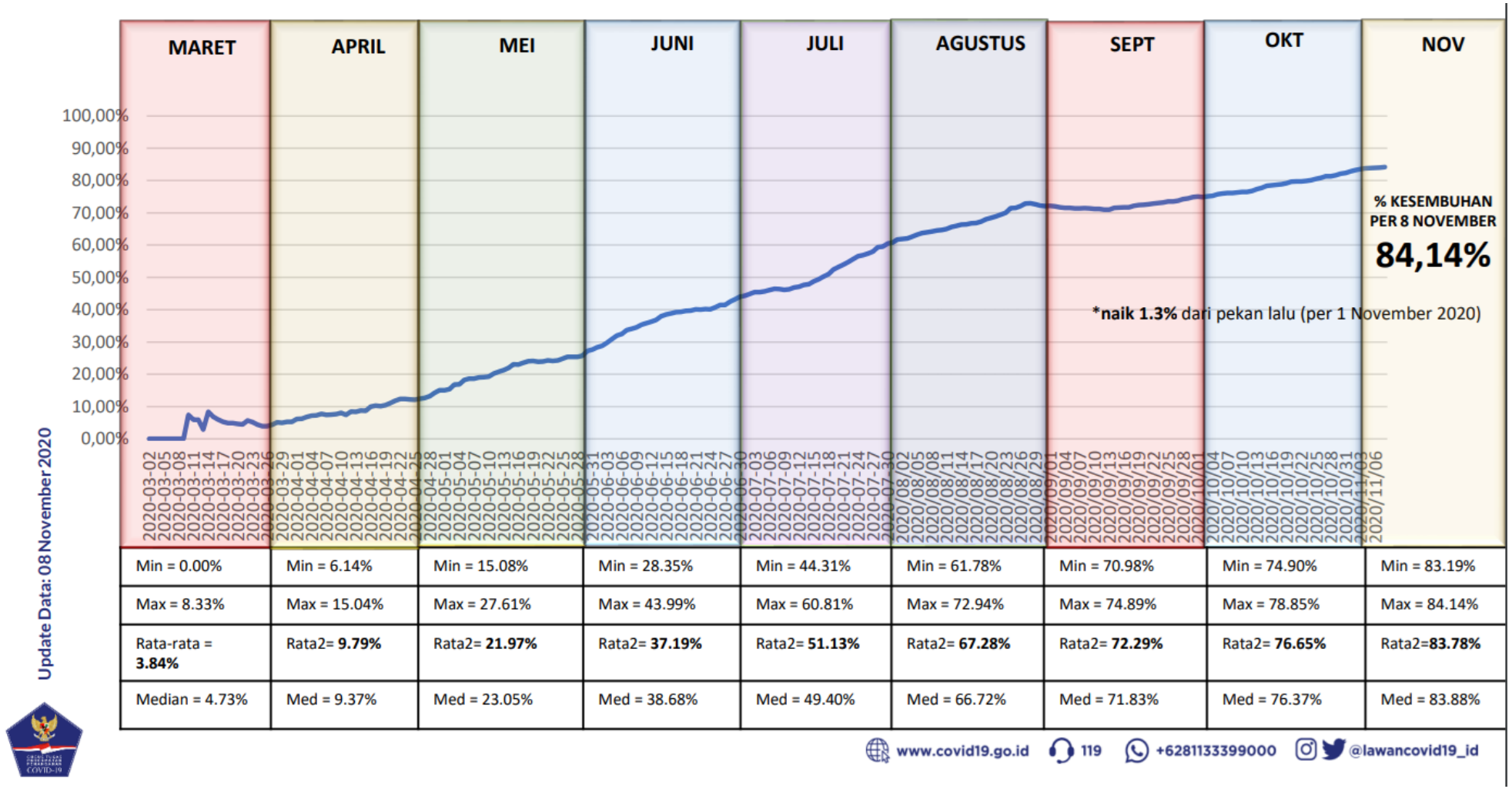

Sumber: Satuan Tugas Penanganan Kasus COVID-19
https://covid19.go.id/p/berita/analisis-data-covid-19-indonesia-update-08-november-2020

Analisis Data
Grafik Distribusi Kasus COVID-19 berdasarkan Jenis Kelamin dan Umur (Update: 8/11/2020)

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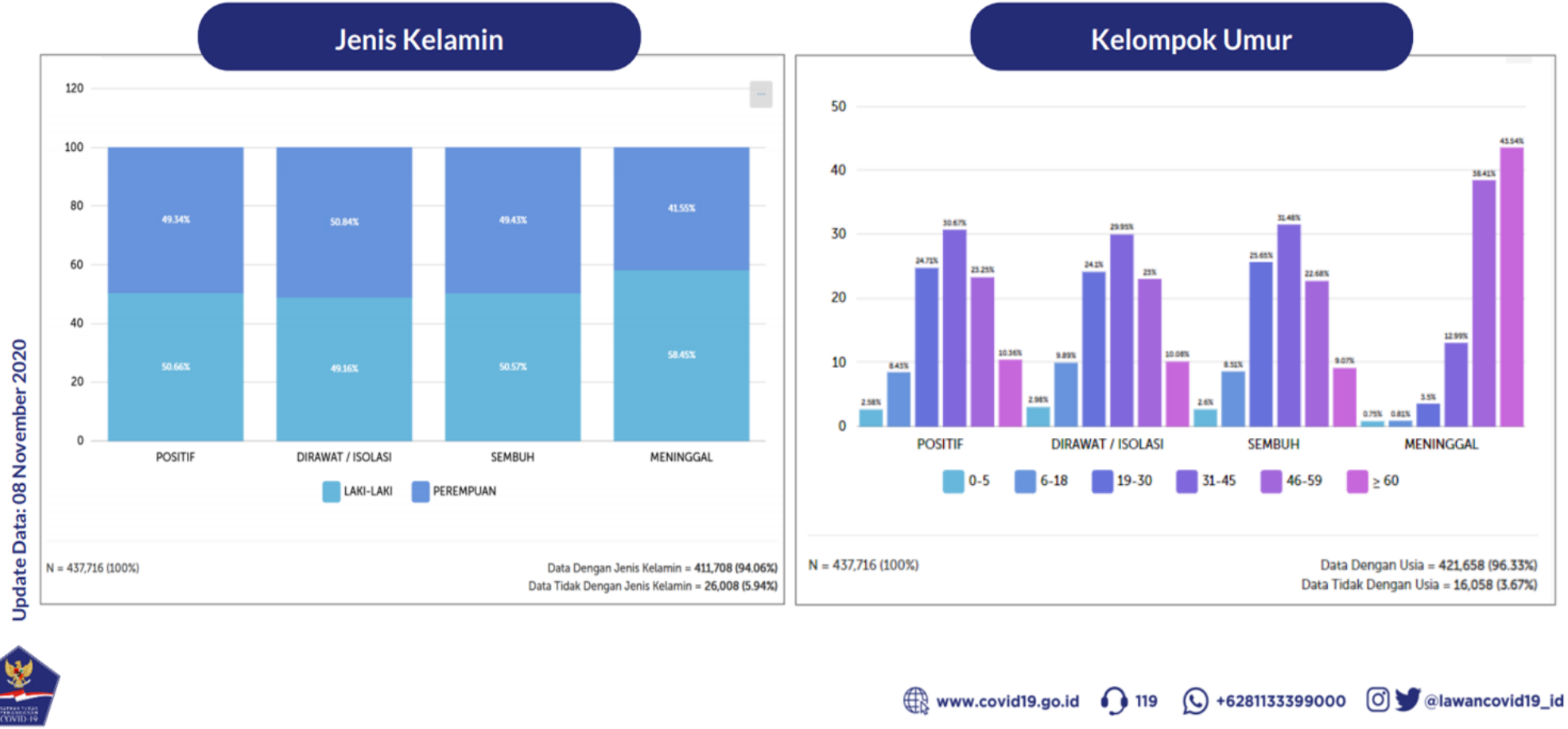

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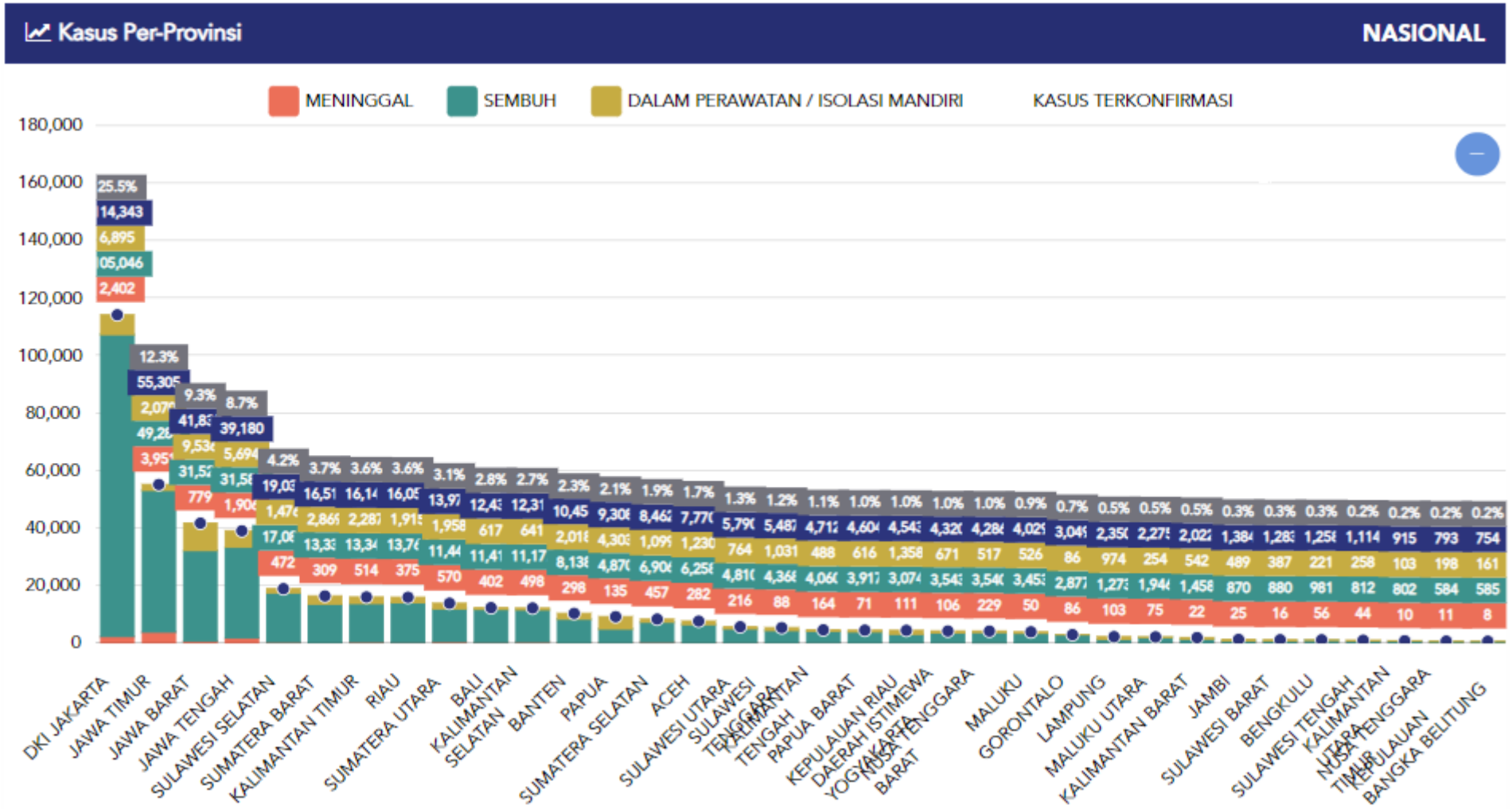
Sumber: Satuan Tugas Penanganan Kasus COVID-19
https://covid19.go.id/p/berita/analisis-data-covid-19-indonesia-update-08-november-2020

Persentase Kasus Aktif, Sembuh dan Meninggal dari Kasus Positif COVID-19 di 34 Provinsi

(Update: 8/11/2020)



Sumber: https://covid19.go.id/peta-sebaran

Analisis Data: Pemetaan Zona Risiko dari 514 Kabupaten/Kota (Update: 8/11/2020)

Sumber: Satuan Tugas Penanganan Kasus COVID-19
https://covid19.go.id/p/berita/analisis-data-covid-19-indonesia-update-08-november-2020

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DATA PENELITIAN PREDIKSI COVID-19 DI INDONESIA

Diyah Utami Kusumaning Putri, S.Kom., M.Sc., M.Cs.
Lab Sistem Cerdas DIKE FMIPA UGM

Sumber Data untuk Penelitian Prediksi COVID-19 di Indonesia

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- **@kawalcovid**
  Sumber data kasus COVID-19 di Indonesia yang tersedia secara publik.

- **JHU CSSE COVID-19 Data**
  Sumber data kasus COVID-19 secara global yang dihimpun oleh Johns Hopkins University Center for Systems Science and Engineering (JHU CSSE)

Sumber: @kawalcovid
https://docs.google.com/spreadsheets/d/1ma1T9hWbec1pXlwZ89WakRk-OfVUQZsOCFl4FwZxzVw/edit#gid=387345074
Sumber: JHU CSSE COVID-19 Data
https://github.com/CSSEGISandData/COVID-19

Sumber Data: @kawalcovid

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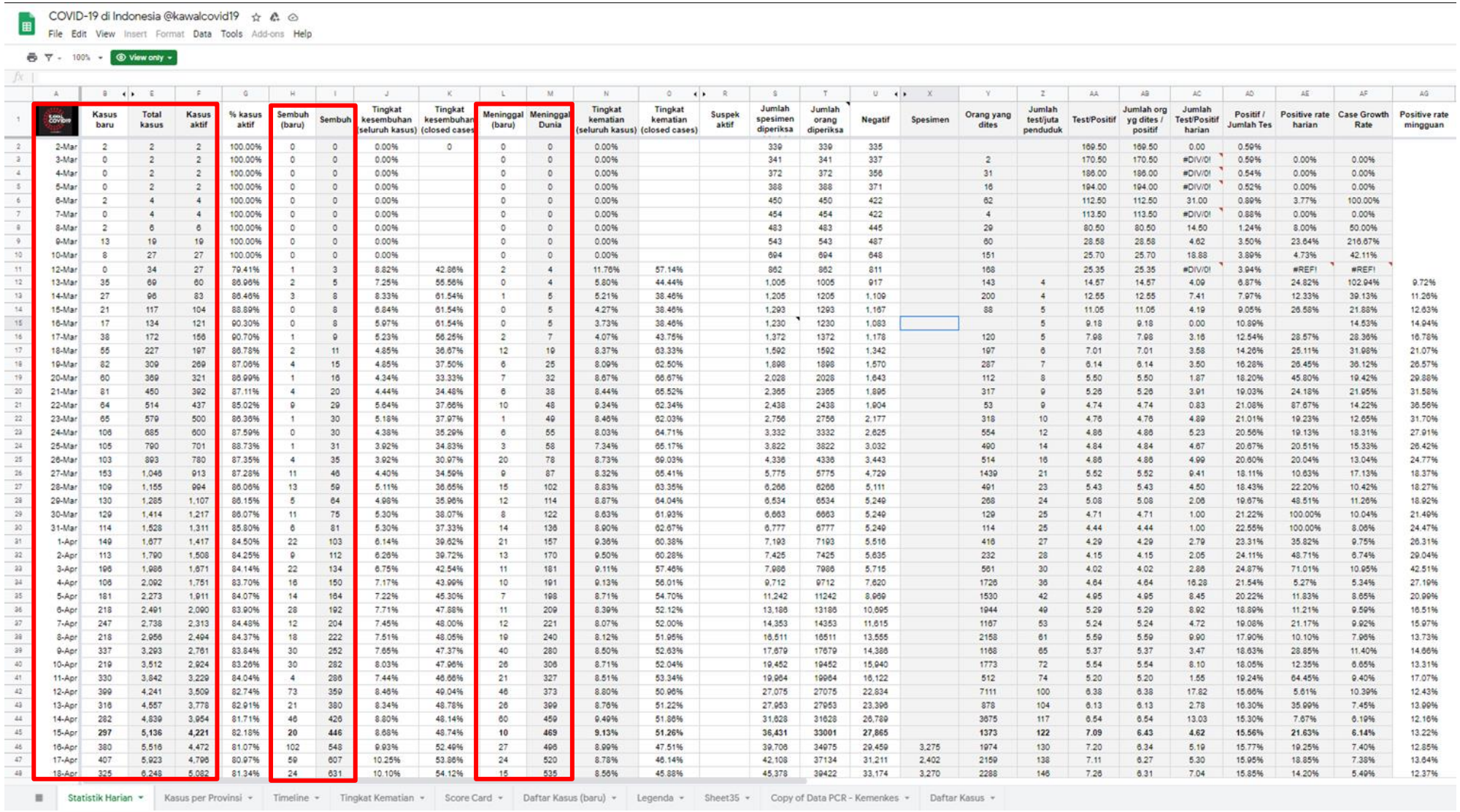


COVID-19 di Indonesia @kawalcovid19

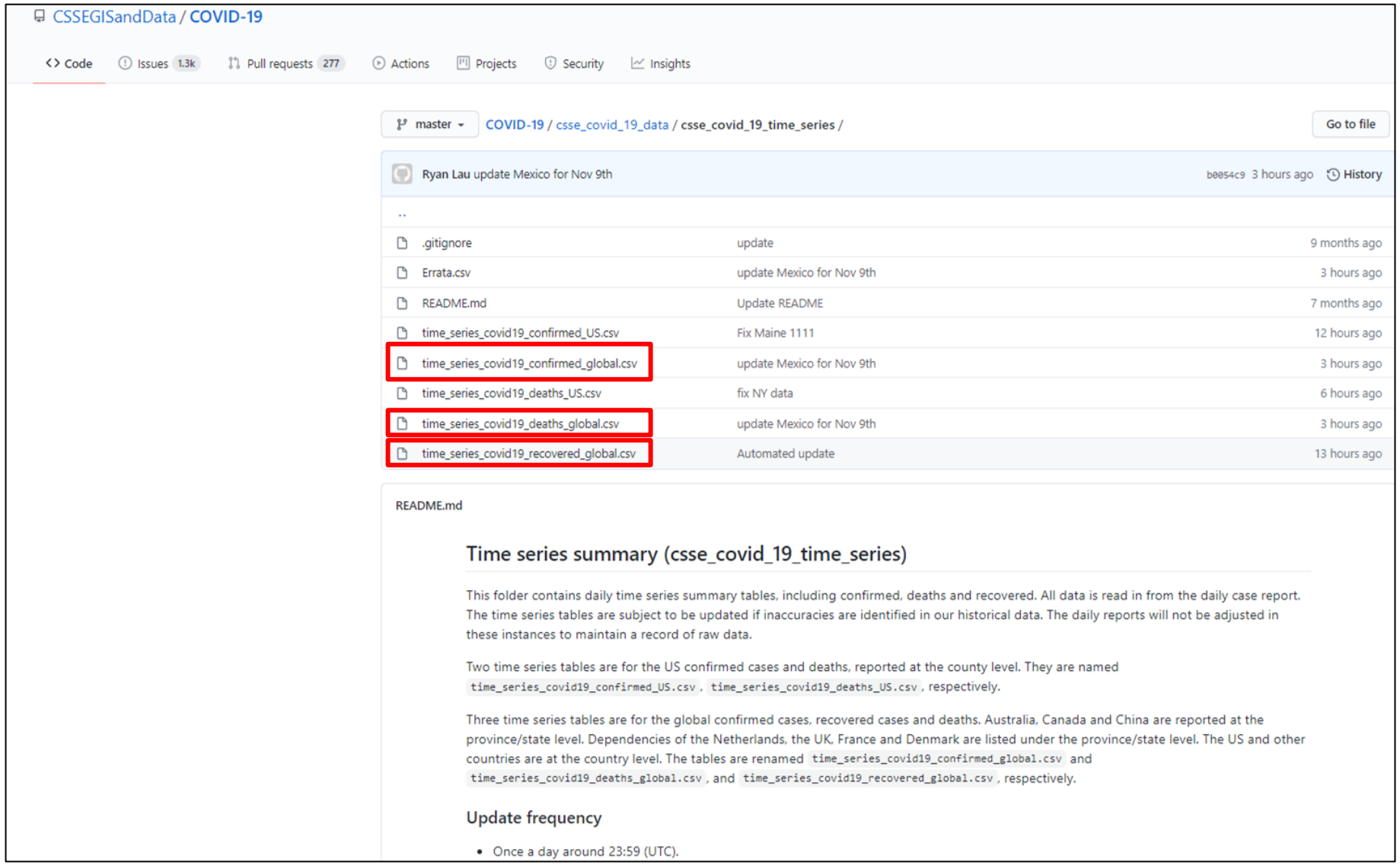
File Edit View Insert Format Data Tools Add-ons Help

	Kasus baru	Total kasus	Kasus aktif	% kasus aktif	Sembuh (baru)	Sembuh	Tingkat kesembuhan (seluruh kasus)	Tingkat kesembuhan (closed cases)	Meninggal (baru)	Meninggal Dunia	Tingkat kematian (seluruh kasus)	Tingkat kematian (closed cases)	Suspek aktif	Jumlah spesimen diperiksa	Jumlah orang diperiksa	Negatif	Spesimen	Orang yang dites	Jumlah test/juta penduduk	Test/Positif	Jumlah org yg dites / positif	Jumlah Test/Positif harian	Positif / Jumlah Tes	Positive rate harian	Case Growth Rate	Positive rate mingguan
2-Mar	2	2	2	100.00%	0	0	0.00%	0	0	0	0.00%			339	339	335				169.50	169.50	0.00	0.59%			
3-Mar	0	2	2	100.00%	0	0	0.00%		0	0	0.00%			341	341	337		2		170.50	170.50	#DIV/0!	0.59%	0.00%	0.00%	
4-Mar	0	2	2	100.00%	0	0	0.00%		0	0	0.00%			372	372	356		31		186.00	186.00	#DIV/0!	0.54%	0.00%	0.00%	
5-Mar	0	2	2	100.00%	0	0	0.00%		0	0	0.00%			388	388	371		16		194.00	194.00	#DIV/0!	0.52%	0.00%	0.00%	
6-Mar	2	4	4	100.00%	0	0	0.00%		0	0	0.00%			450	450	422		62		112.50	112.50	31.00	0.89%	3.77%	100.00%	
7-Mar	0	4	4	100.00%	0	0	0.00%		0	0	0.00%			454	454	422		4		113.50	113.50	#DIV/0!	0.88%	0.00%	0.00%	
8-Mar	2	6	6	100.00%	0	0	0.00%		0	0	0.00%			483	483	445		29		80.50	80.50	14.50	1.24%	8.00%	50.00%	
9-Mar	13	19	19	100.00%	0	0	0.00%		0	0	0.00%			543	543	487		60		28.58	28.58	4.62	3.50%	23.64%	216.67%	
10-Mar	8	27	27	100.00%	0	0	0.00%		0	0	0.00%			694	694	648		151		25.70	25.70	18.88	3.89%	4.73%	42.11%	
11-Mar	0	34	27	79.41%	1	3	8.82%	42.86%	2	4	11.76%	57.14%		862	862	811		168		25.35	25.35	#DIV/0!	3.94%	#REF!	#REF!	
12-Mar	35	69	60	86.96%	2	5	7.25%	55.56%	0	4	5.80%	44.44%		1,005	1005	917		143	4	14.57	14.57	4.09	6.87%	24.82%	102.94%	9.72%
13-Mar	27	96	83	86.46%	3	8	8.33%	61.54%	1	5	5.21%	38.46%		1,205	1205	1,109		200	4	12.55	12.55	7.41	7.97%	12.33%	39.13%	11.26%
14-Mar	21	117	104	88.89%	0	8	6.84%	61.54%	0	5	4.27%	38.46%		1,293	1293	1,167		88	5	11.05	11.05	4.19	9.05%	26.58%	21.88%	12.63%
15-Mar	17	134	121	90.30%	0	8	5.97%	61.54%	0	5	3.73%	38.46%		1,230	1230	1,083			5	9.18	9.18	0.00	10.89%		14.53%	14.94%
16-Mar	38	172	156	90.70%	1	9	5.23%	56.25%	2	7	4.07%	43.75%		1,372	1372	1,178		120	5	7.98	7.98	3.16	12.54%	28.57%	28.36%	16.78%
17-Mar	55	227	197	86.78%	2	11	4.85%	36.67%	12	19	8.37%	63.33%		1,592	1592	1,342		197	6	7.01	7.01	3.58	14.26%	25.11%	31.98%	21.07%
18-Mar	82	309	269	87.06%	4	15	4.85%	37.50%	6	25	8.09%	62.50%		1,898	1898	1,570		287	7	6.14	6.14	3.50	16.28%	26.45%	36.12%	26.57%
19-Mar	60	369	321	86.99%	1	16	4.34%	33.33%	7	32	8.67%	66.67%		2,028	2028	1,643		112	8	5.50	5.50	1.87	18.20%	45.80%	19.42%	29.88%
20-Mar	81	450	392	87.11%	4	20	4.44%	34.48%	6	38	8.44%	65.52%		2,365	2365	1,895		317	9	5.26	5.26	3.91	19.03%	24.18%	21.95%	31.58%
21-Mar	64	514	437	85.02%	9	29	5.64%	37.66%	10	48	9.34%	62.34%		2,438	2438	1,904		53	9	4.74	4.74	0.83	21.08%	87.67%	14.22%	36.56%
22-Mar	65	579	500	86.36%	1	30	5.18%	37.97%	1	49	8.46%	62.03%		2,756	2756	2,177		318	10	4.76	4.76	4.89	21.01%	19.23%	12.65%	31.70%
23-Mar	106	685	600	87.59%	0	30	4.38%	35.29%	6	55	8.03%	64.71%		3,332	3332	2,625		554	12	4.86	4.86	5.23	20.56%	19.13%	18.31%	27.91%
24-Mar	105	790	701	88.73%	1	31	3.92%	34.83%	3	58	7.34%	65.17%		3,822	3822	3,032		490	14	4.84	4.84	4.67	20.67%	20.51%	15.33%	26.42%
25-Mar	103	893	780	87.35%	4	35	3.92%	30.97%	20	78	8.73%	69.03%		4,336	4336	3,443		514	16	4.86	4.86	4.99	20.60%	20.04%	13.04%	24.77%
26-Mar	153	1,046	913	87.28%	11	46	4.40%	34.59%	9	87	8.32%	65.41%		5,775	5775	4,729		1439	21	5.52	5.52	9.41	18.11%	10.63%	17.13%	18.37%
27-Mar	109	1,155	994	86.06%	13	59	5.11%	36.65%	15	102	8.83%	63.35%		6,266	6266	5,111		491	23	5.43	5.43	4.50	18.43%	22.20%	10.42%	18.27%
28-Mar	130	1,285	1,107	86.15%	5	64	4.98%	35.96%	12	114	8.87%	64.04%		6,534	6534	5,249		268	24	5.08	5.08	2.06	19.67%	48.51%	11.26%	18.92%
29-Mar	129	1,414	1,217	86.07%	11	75	5.30%	38.07%	8	122	8.63%	61.93%		6,663	6663	5,249		129	25	4.71	4.71	1.00	21.22%	100.00%	10.04%	21.49%
30-Mar	114	1,528	1,311	85.80%	6	81	5.30%	37.33%	14	136	8.90%	62.67%		6,777	6777	5,249		114	25	4.44	4.44	1.00	22.55%	100.00%	8.06%	24.47%
31-Mar	149	1,677	1,417	84.50%	22	103	6.14%	39.62%	21	157	9.36%	60.38%		7,193	7193	5,516		416	27	4.29	4.29	2.79	23.31%	35.82%	9.75%	26.31%
1-Apr	113	1,790	1,508	84.25%	9	112	6.26%	39.72%	13	170	9.50%	60.28%		7,425	7425	5,635		232	28	4.15	4.15	2.05	24.11%	48.71%	6.74%	29.04%
2-Apr	196	1,986	1,671	84.14%	22	134	6.75%	42.54%	11	181	9.11%	57.46%		7,986	7986	5,715		561	30	4.02	4.02	2.86	24.87%	71.01%	10.95%	42.51%
3-Apr	106	2,092	1,751	83.70%	16	150	7.17%	43.99%	10	191	9.13%	56.01%		9,712	9712	7,620		1726	36	4.64	4.64	16.28	21.54%	5.27%	5.34%	27.19%
4-Apr	181	2,273	1,911	84.07%	14	164	7.22%	45.30%	7	198	8.71%	54.70%		11,242	11242	8,999		1530	42	4.95	4.95	8.45	20.22%	11.83%	8.65%	20.99%
5-Apr	218	2,491	2,090	83.90%	28	192	7.71%	47.88%	11	209	8.39%	52.12%		13,186	13186	10,695		1944	49	5.29	5.29	8.92	18.89%	11.21%	9.59%	16.51%
6-Apr	247	2,738	2,313	84.48%	12	204	7.45%	48.00%	12	221	8.07%	52.00%		14,353	14353	11,615		1167	53	5.24	5.24	4.72	19.08%	21.17%	9.92%	15.97%
7-Apr	218	2,956	2,494	84.37%	18	222	7.51%	48.05%	19	240	8.12%	51.95%		16,511	16511	13,555		2158	61	5.59	5.59	9.90	17.90%	10.10%	7.96%	13.73%
8-Apr	337	3,293	2,761	83.84%	30	252	7.65%	47.37%	40	280	8.50%	52.63%		17,679	17679	14,386		1168	65	5.37	5.37	3.47	18.63%	28.85%	11.40%	14.66%
9-Apr	219	3,512	2,924	83.26%	30	282	8.03%	47.96%	26	306	8.71%	52.04%		19,452	19452	15,940		1773	72	5.54	5.54	8.10	18.05%	12.35%	8.65%	13.31%
10-Apr	330	3,842	3,229	84.04%	4	286	7.44%	46.66%	21	327	8.51%	53.34%		19,984	19984	16,122		512	74	5.20	5.20	1.55	19.24%	64.45%	9.40%	17.07%
11-Apr	399	4,241	3,509	82.74%	73	359	8.46%	49.04%	46	373	8.80%	50.96%		27,075	27075	22,834		7111	100	6.38	6.38	17.82	15.66%	5.61%	10.39%	12.43%
12-Apr	316	4,557	3,778	82.91%	21	380	8.34%	48.78%	26	399	8.76%	51.22%		27,953	27953	23,396		878	104	6.13	6.13	2.78	16.30%	35.99%	7.45%	13.99%
13-Apr	282	4,839	3,954	81.71%	46	426	8.80%	48.14%	60	459	9.49%	51.86%		31,628	31628	26,789		3675	117	6.54	6.54	13.03	15.30%	7.67%	6.19%	12.16%
14-Apr	297	5,136	4,221	82.18%	20	446	8.68%	48.74%	10	469	9.13%	51.26%		36,431	33001	27,865		1373	122	7.09	6.43	4.62	15.56%	21.63%	6.14%	13.22%
15-Apr	380	5,516	4,472	81.07%	102	548	9.93%	52.49%	27	496	8.99%	47.51%		39,706	34975	29,459	3,275	1974	130	7.20	6.34	5.19	15.77%	19.25%	7.40%	12.85%
16-Apr	407	5,923	4,796	80.97%	59	607	10.25%	53.86%	24	520	8.78%	46.14%		42,108	37134	31,211	2,402	2159	138	7.11	6.27	5.30	15.95%	18.85%	7.38%	13.64%
17-Apr	325	6,248	5,082	81.34%	24	631	10.10%	54.12%	15	535	8.56%	45.88%		45,378	39422	33,174	3,270	2288	146	7.26	6.31	7.04	15.85%	14.20%	5.49%	12.37%

Statistik Harian | Kasus per Provinsi | Timeline | Tingkat Kematian | Score Card | Daftar Kasus (baru) | Legenda | Sheet35 | Copy of Data PCR - Kemenkes | Daftar Kasus

Sumber: @kawalcovid
https://docs.google.com/spreadsheets/d/1ma1T9hWbec1pXlwZ89WakRk-OfVUQZsOCFl4FwZxzVw/edit#gid=387345074

Sumber Data: JHU CSSE COVID-19 Data



CSSEGISandData / COVID-19

Code | Issues 1.3k | Pull requests 277 | Actions | Projects | Security | Insights

master · COVID-19 / csse_covid_19_data / csse_covid_19_time_series / · Go to file

Ryan Lau update Mexico for Nov 9th — b0054c9 3 hours ago · History

.gitignore	update	9 months ago
Errata.csv	update Mexico for Nov 9th	3 hours ago
README.md	Update README	7 months ago
time_series_covid19_confirmed_US.csv	Fix Maine 1111	12 hours ago
time_series_covid19_confirmed_global.csv	update Mexico for Nov 9th	3 hours ago
time_series_covid19_deaths_US.csv	fix NY data	6 hours ago
time_series_covid19_deaths_global.csv	update Mexico for Nov 9th	3 hours ago
time_series_covid19_recovered_global.csv	Automated update	13 hours ago

README.md

Time series summary (csse_covid_19_time_series)

This folder contains daily time series summary tables, including confirmed, deaths and recovered. All data is read in from the daily case report. The time series tables are subject to be updated if inaccuracies are identified in our historical data. The daily reports will not be adjusted in these instances to maintain a record of raw data.

Two time series tables are for the US confirmed cases and deaths, reported at the county level. They are named `time_series_covid19_confirmed_US.csv`, `time_series_covid19_deaths_US.csv`, respectively.

Three time series tables are for the global confirmed cases, recovered cases and deaths. Australia, Canada and China are reported at the province/state level. Dependencies of the Netherlands, the UK, France and Denmark are listed under the province/state level. The US and other countries are at the country level. The tables are renamed `time_series_covid19_confirmed_global.csv` and `time_series_covid19_deaths_global.csv`, and `time_series_covid19_recovered_global.csv`, respectively.

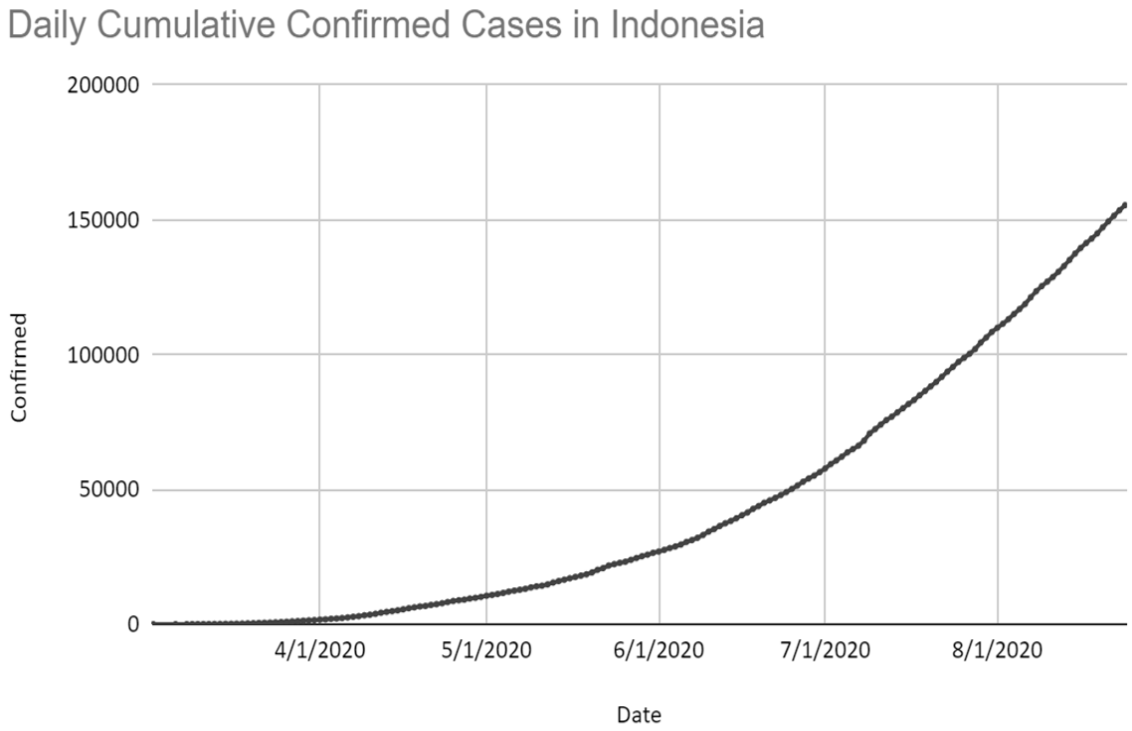
Update frequency

- Once a day around 23:59 (UTC).

Sumber: JHU CSSE COVID-19 Data
https://github.com/CSSEGISandData/COVID-19

Data Penelitian
Prediksi COVID-19 di Indonesia

- Sumber data yang digunakan pada penelitian berasal dari @kawalcovid
- Data yang diambil berfokus pada kasus kumulatif harian yang terkonfirmasi positif, sembuh, meninggal dan pasien dalam perawatan (kasus aktif)
- Data yang digunakan adalah data kasus sejak 2 Maret 2020 hingga 7 November 2020



Sumber: **@kawalcovid**
https://docs.google.com/spreadsheets/d/1ma1T9hWbec1pXlwZ89WakRk-OfVUQZsOCFl4FwZxzVw/edit#gid=387345074

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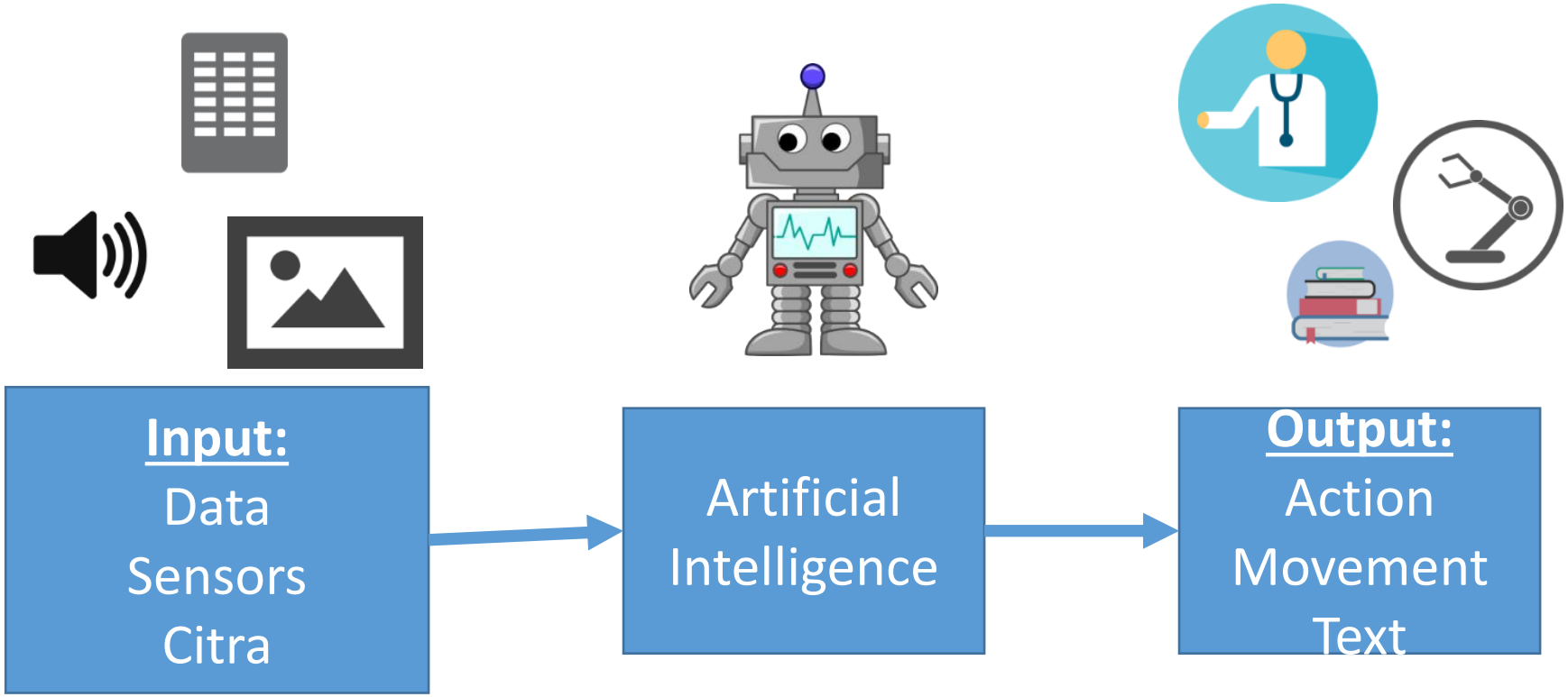
METODE AI UNTUK PREDIKSI

Prof. Dra. Sri Hartati, M.Sc., Ph.D.
Lab Sistem Cerdas DIKE FMIPA UGM

Agenda

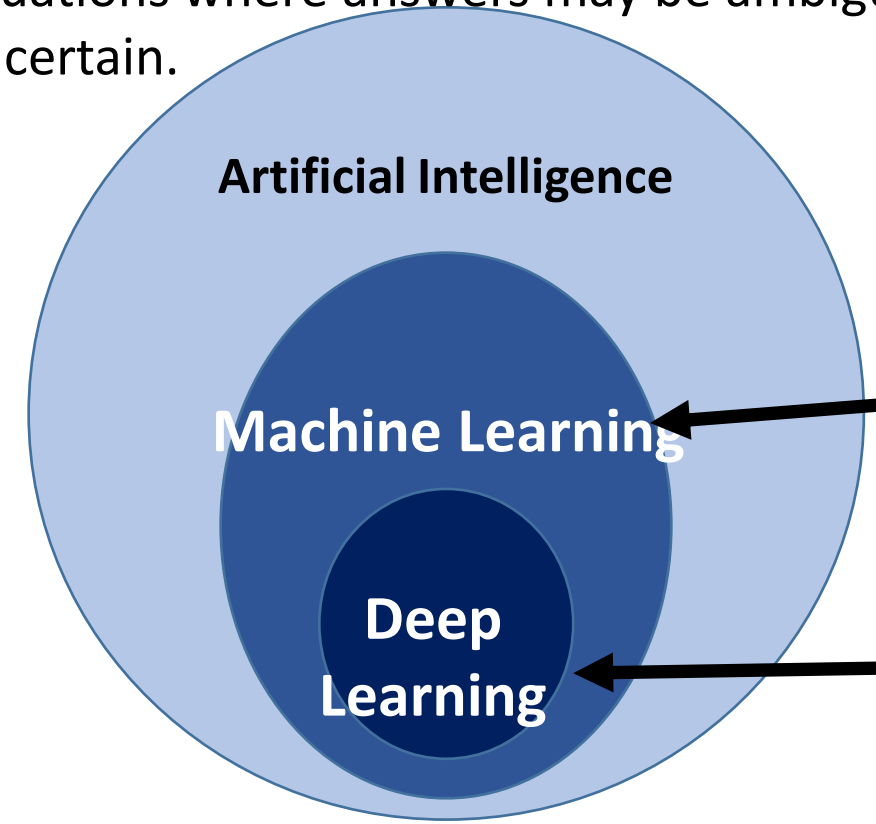
- Prediksi
- AI
- Metode AI untuk prediksi
- Aplikasi prediksi

Apa itu Kecerdasan Artificial (*AI*)



Artificial Intelligence

- Computer systems simulate human intelligence processes, including: learning, reasoning, self-correction.
- "Cognitive computing" find solutions in complex situations where answers may be ambiguous and uncertain.



Machine Learning is a subset of Artificial Intelligence

Deep Learning is a subset of Machine Learning

Deep Learning uses neural networks to simulate human like decision making

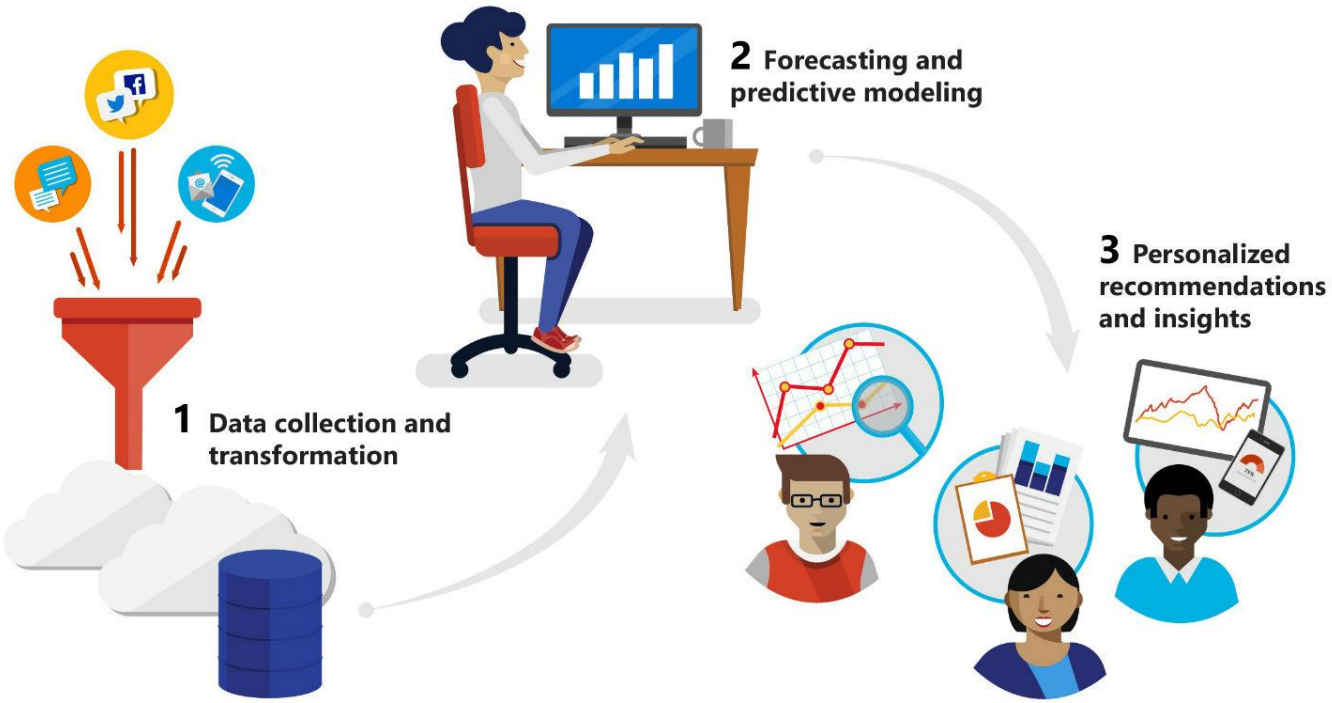
Machine Learning

- Computer systems that learn by generalizing data examples without relying on rules-based programming.
- Supervised, Unsupervised, and Reinforcement Learning

PREDIKSI

Proses memperkirakan secara sistematis tentang sesuatu yang paling mungkin terjadi di masa yang akan datang berdasarkan informasi masa lalu dan sekarang yang dimiliki

Selisih antara sesuatu yang terjadi dengan hasil perkiraan, dapat diperoleh sekecil mungkin



Pemodelan prediktif dg Kecerdasan Artifisial

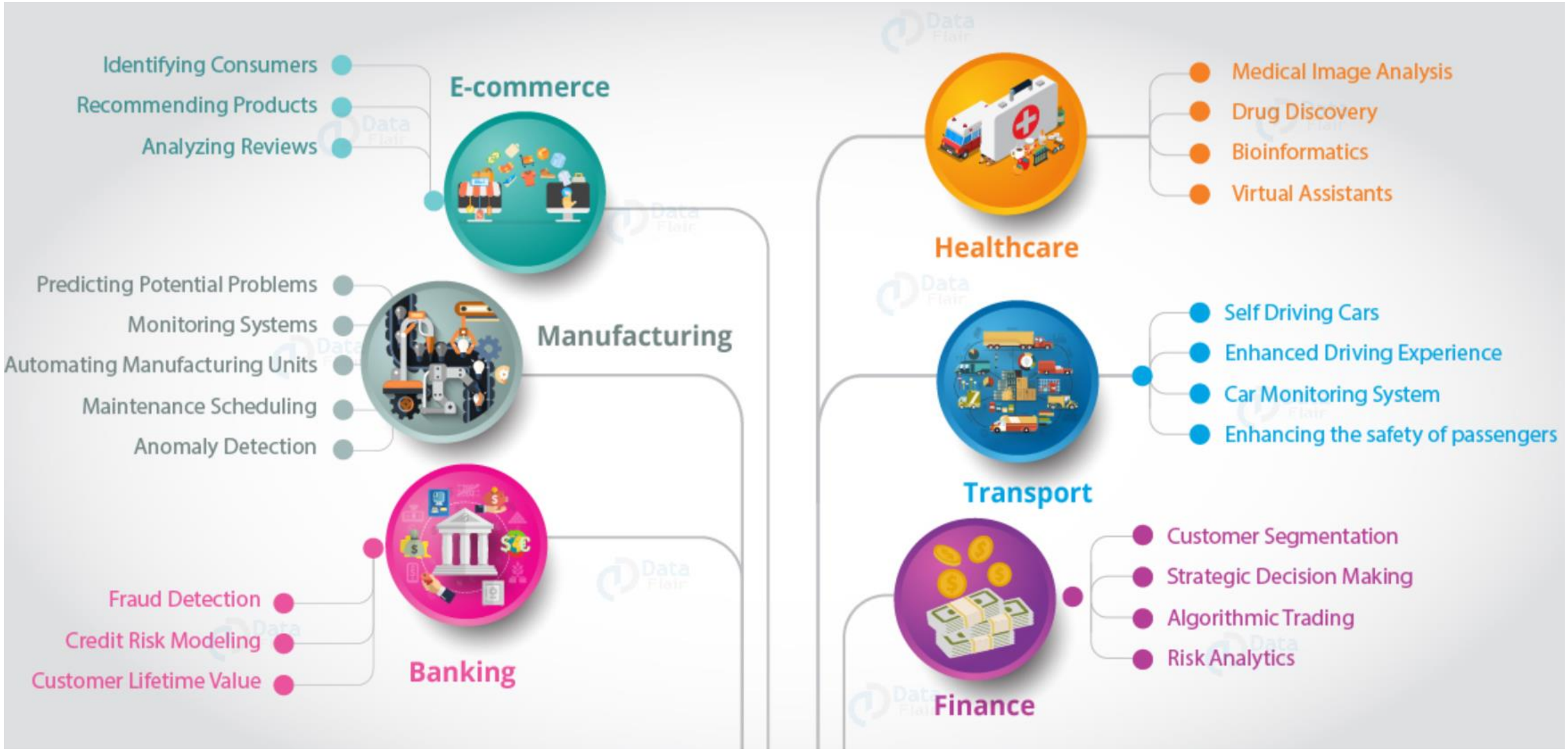
- Pemodelan prediktif adalah praktik mengekstraksi wawasan dari kumpulan data yang ada dengan bantuan teknik kecerdasan artifisial (AI) / pembelajaran mesin, penambangan data, pemodelan statistik, dan menggunakannya untuk memprediksi peristiwa di masa depan.

Pemodelan prediktif dg Kecerdasan Artifisial

- Kecerdasan artifisial dapat dipandang sebagai seperangkat alat untuk membuat model prediktif kita
- Pemodelan prediktif dan kecerdasan buatan tidak dapat menjamin hasil tetapi dapat membantu meminimalkan risiko dan mengurangi ketidakpastian.

- Fokus utama kecerdasan artifisial; secara otomatis belajar mengenali pola-pola kompleks dan membuat keputusan cerdas berdasarkan data.

Aplikasi Model Prediktif



Metode Pemodelan Prediktif

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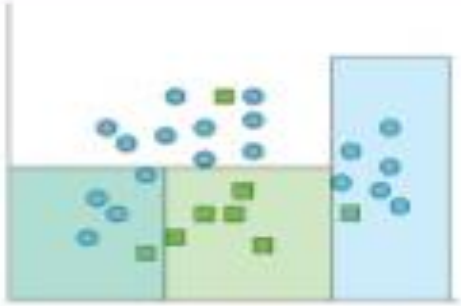
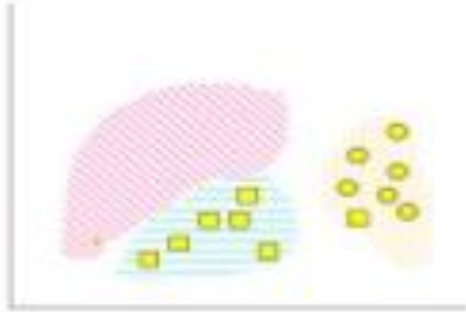
Classification



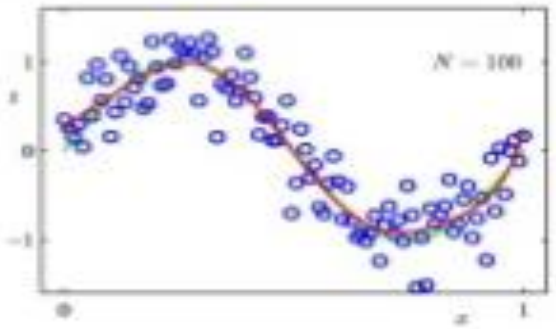
Learns a method for predicting the instance class from pre-labeled (classified) instances

Clustering



Finds "natural" grouping of instances given un-labeled data

Regression

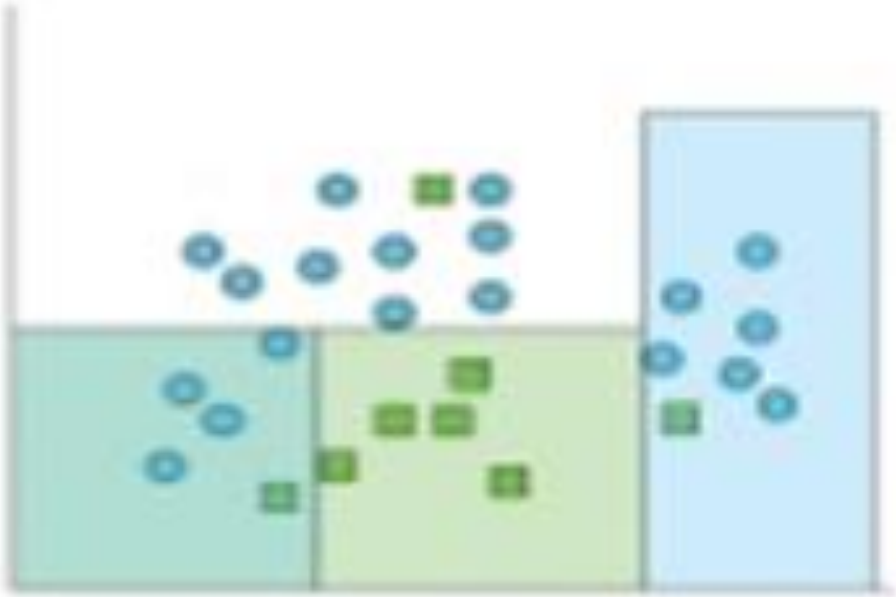


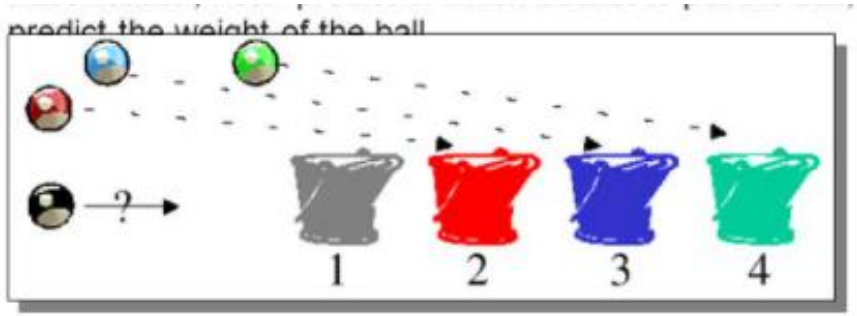
An attempt to predict a continuous attribute

Association Rules

Method for discovering interesting relations between variables in large DBs

Klasifikasi

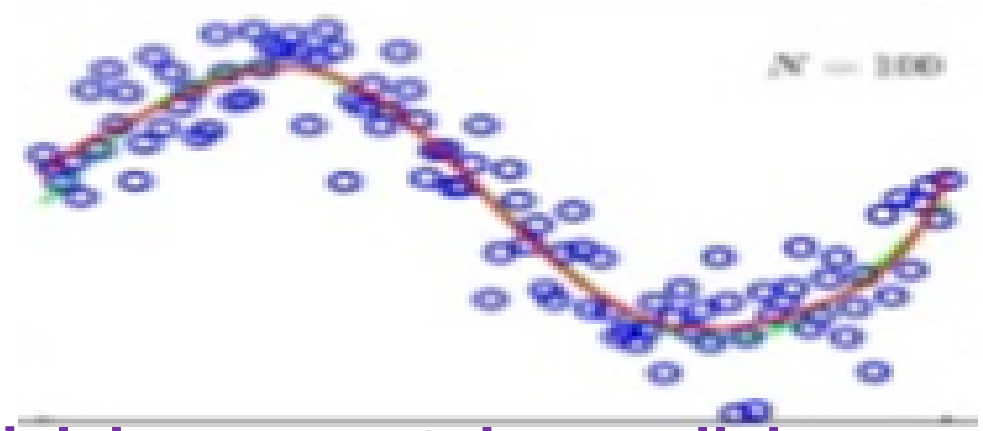




- Klasifikasi adalah menetapkan item dalam koleksi, ke kategori atau kelas target.
- Tujuan klasifikasi adalah memprediksi target secara akurat untuk setiap kasus dalam data.
- Misalnya, model klasifikasi dapat digunakan untuk mengidentifikasi pemohon pinjaman risiko sebagai kredit rendah, menengah, atau tinggi.

- Contoh Bank, memprediksi pelanggan mana (pemohon pinjaman) yang berisiko atau mana yang aman.

Regresi

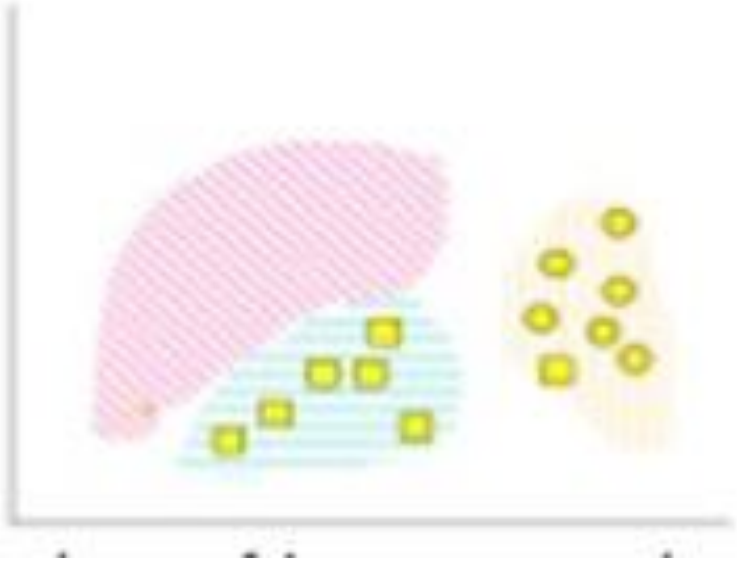


- **Regresi - adalah cara untuk memilah secara matematis variabel mana yang benar-benar berpengaruh.**
  - **Faktor mana yang paling penting? Mana yang bisa kita abaikan? Bagaimana faktor-faktor tersebut berinteraksi satu sama lain?**

- Untuk memprediksi penjualan masa depan suatu Perusahaan berdasarkan kondisi ekonomi saat ini.

- Untuk membandingkan pengaruh variabel yang diukur pada skala yang berbeda, seperti pengaruh perubahan harga dan jumlah kegiatan promosi

Klasterisasi



- Klasterisasi adalah metode pengelompokan data.
- **P**roses partisi satu set objek data ke dalam himpunan bagian yang disebut dengan **cluster**. Objek yang di dalam **cluster** memiliki kemiripan karakteristik antar satu sama lainnya dan berbeda dengan obyek pada **cluster** yang lain.

- Misal, digunakan oleh perusahaan besar untuk segmentasi pasar / pelanggan

Aturan asosiasi

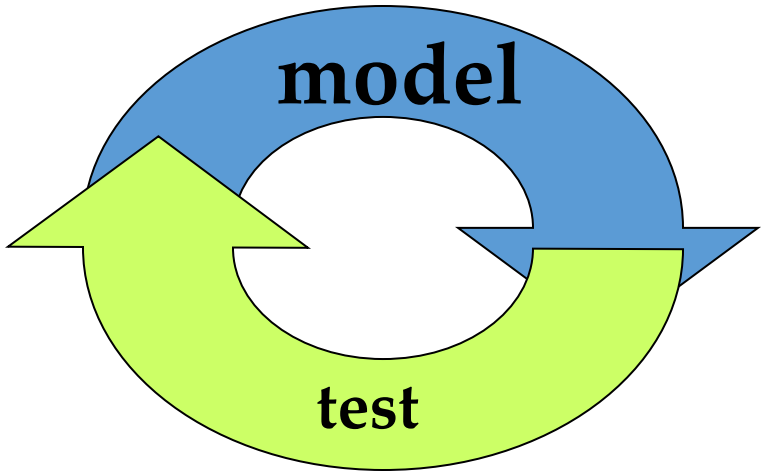
- **Penambangan aturan asosiasi (*Association rule mining*)**

  Aturan asosiasi digunakan untuk membantu dalam pengelompokan silang berdasarkan data input.

- **Misalnya pelanggan yang sering membeli roti dan minuman soda dan sering membeli keripik secara bersama-sama.**

Penerapan Metode

- Amati suatu event(s).
- Kembangkan model (atau hipotesis) yang membuat prediksi untuk menjelaskan peristiwa tersebut
- Uji prediksi dengan data
- Amati hasilnya.
- Merevisi model.
- Ulangi sesuai kebutuhan.
- Model Hipotesis yang berhasil menjadi Teori Ilmiah.



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AI METHODS FOR TIME SERIES FORECASTING

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Lab Sistem Cerdas DIKE FMIPA UGM

Time Series

Time series can be defined as a sequence of a metric is recorded over regular time intervals.

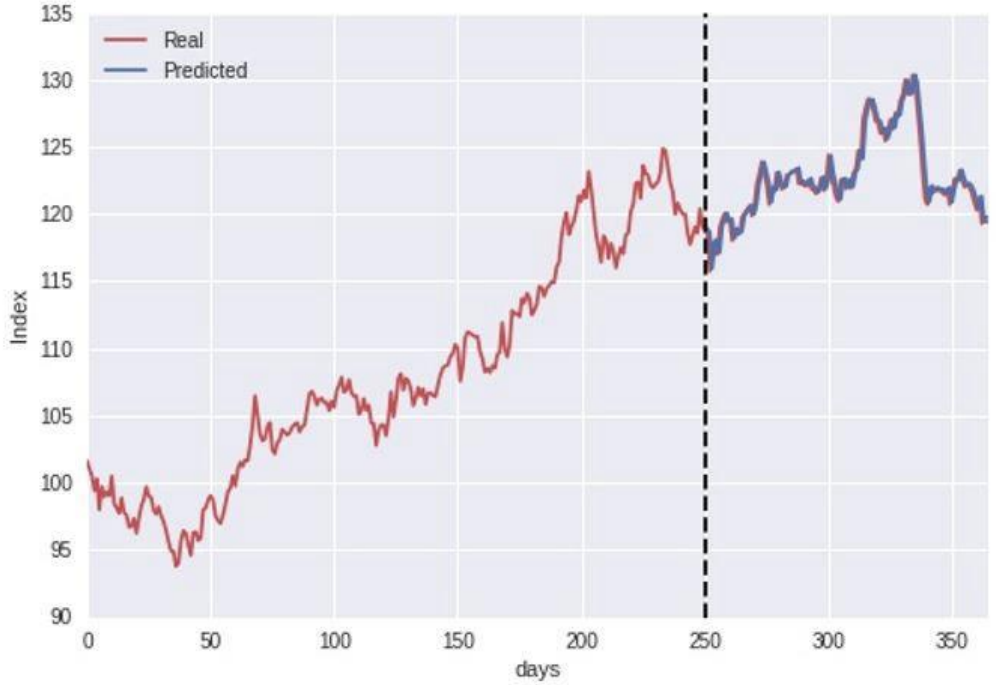
Depending on the frequency, a time series can be of yearly, quarterly, monthly etc.

https://towardsdatascience.com/how-not-to-use-machine-learning-for-time-series-forecasting-avoiding-the-pitfalls-19f9d7adf424
https://towardsdatascience.com/introduction-to-time-series-forecasting-7e03c4bd83e0

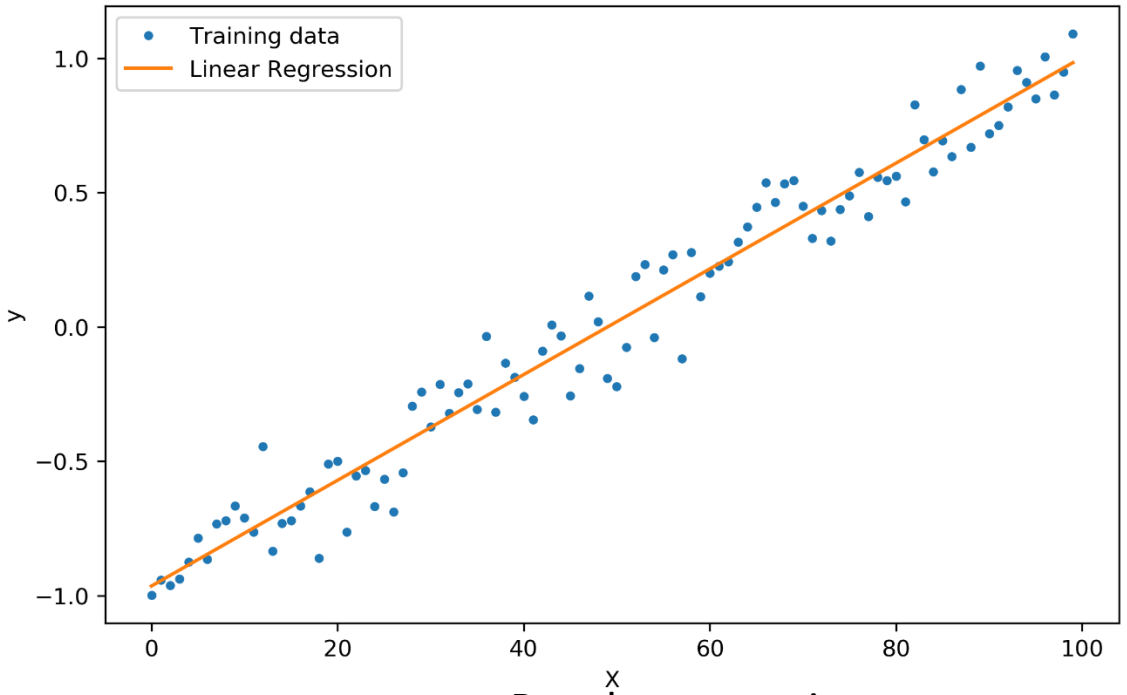
Application of Time Series Analysis

Source: https://medium.com/analytics-steps/introduction-to-time-series-analysis-time-series-forecasting-machine-learning-methods-models-ecaa76a7b0e3

Time Series vs Regression Problem



Time Series



Regular regression

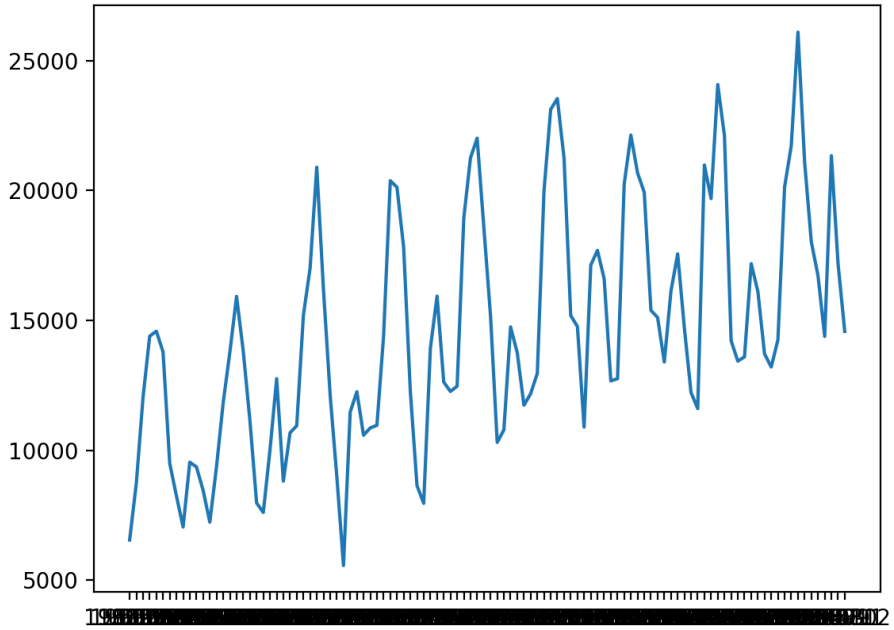
Source:
https://www.kdnuggets.com/2019/05/machine-learning-time-series-forecasting.html
https://mlfromscratch.com/machine-learning-introduction-8-linear-regression-and-logistic-regression/

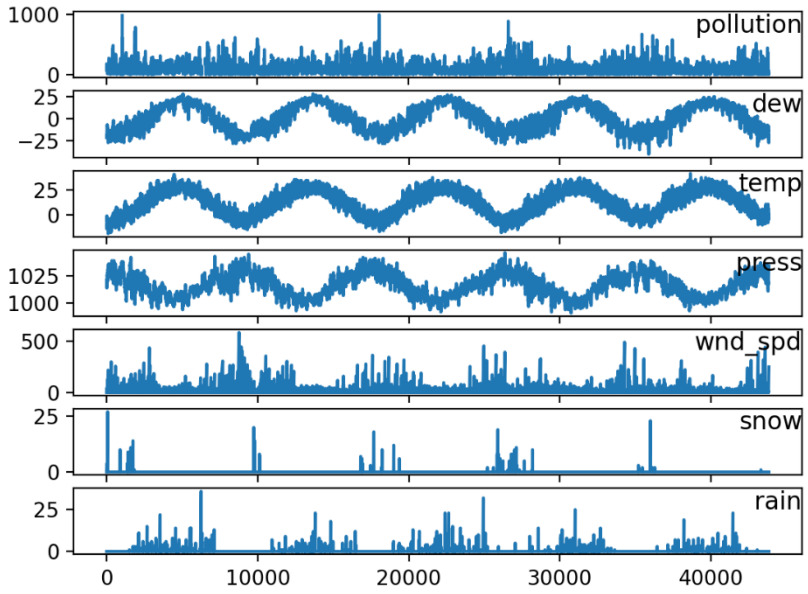
Time Series vs Regression Problem

- **Time-dependent**. In linear regression models, observations are independent. But in time series, observations depend on time

Seasonality trends, where variations specific to a particular time frame.

Methods



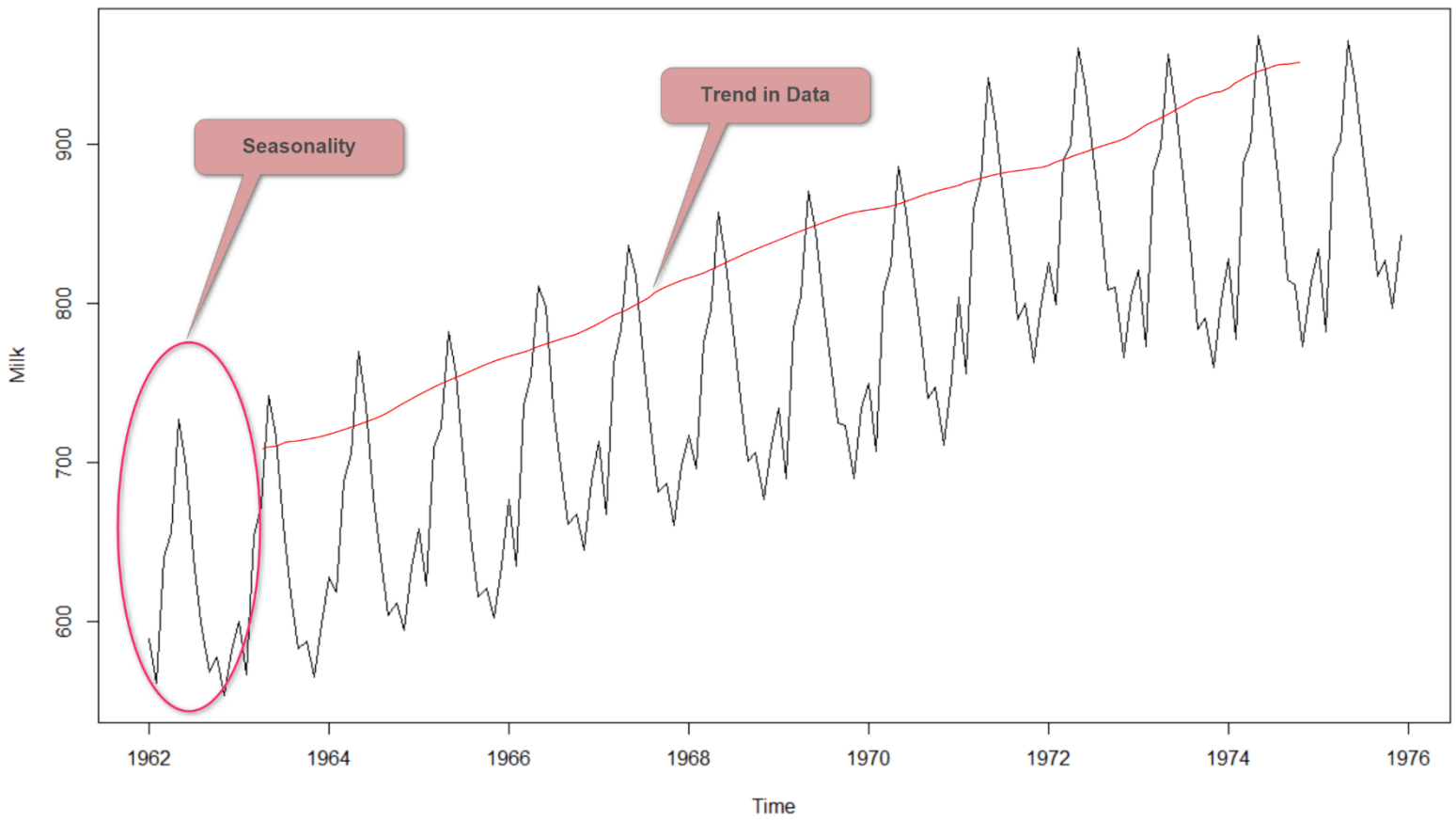


- **Univariate Time-series Forecasting**: only two variables in which one is time and the other is the field to forecast.
- **Multivariate Time-series Forecasting:** contain multiple variables keeping one variable as time and others will be multiple in parameters.

https://machinelearningmastery.com/time-series-forecasting/

Special Characteristics

- **Trend**: the trend is showing the general tendency of the data to increase or decrease with time.
- **Seasonality**: Seasonality in a time series is a regular pattern of changes that repeats over S time periods, where S defines the number of periods until the pattern repeats.



Special Characteristics

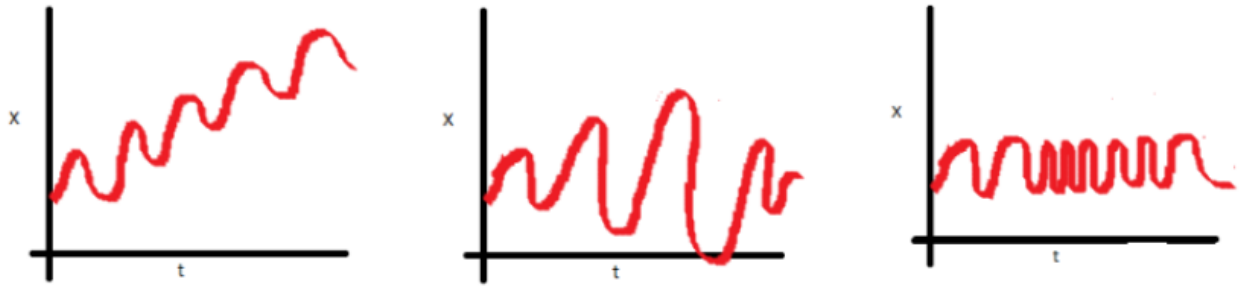


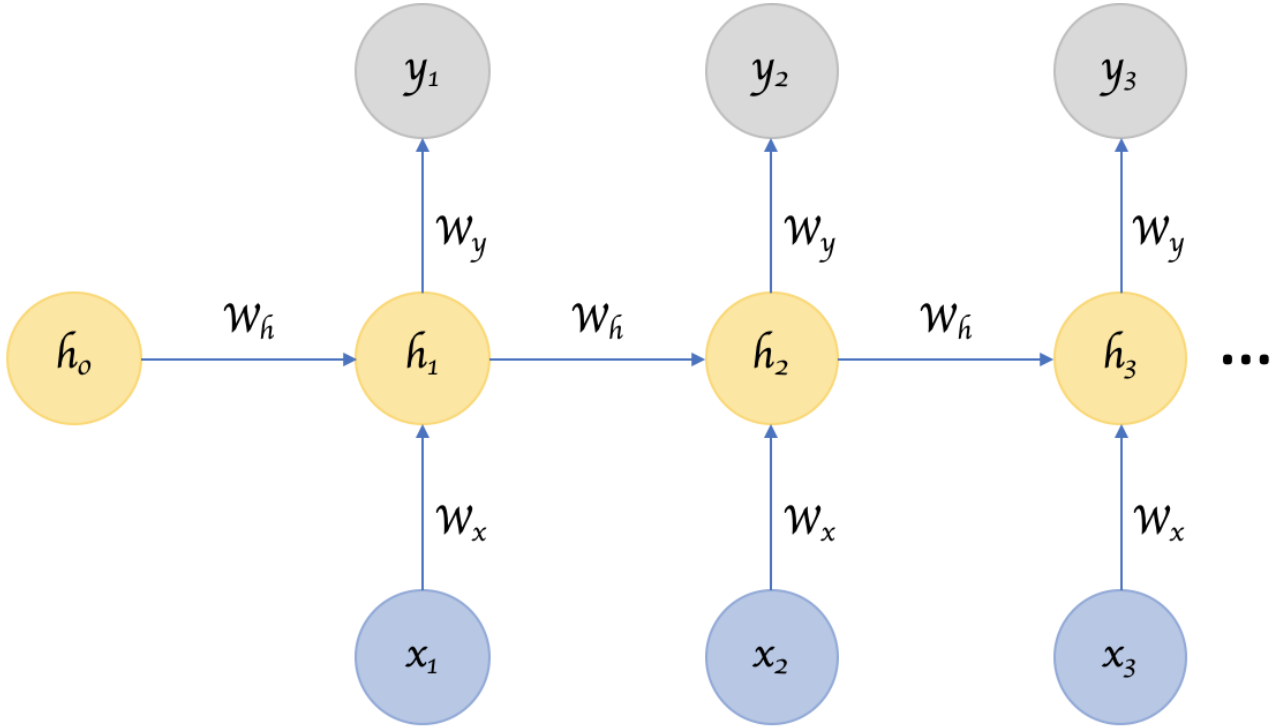
Image credit: https://cdn.analyticsvidhya.com/wp-content/uploads/2018/09/ns5-e1536673990684.png

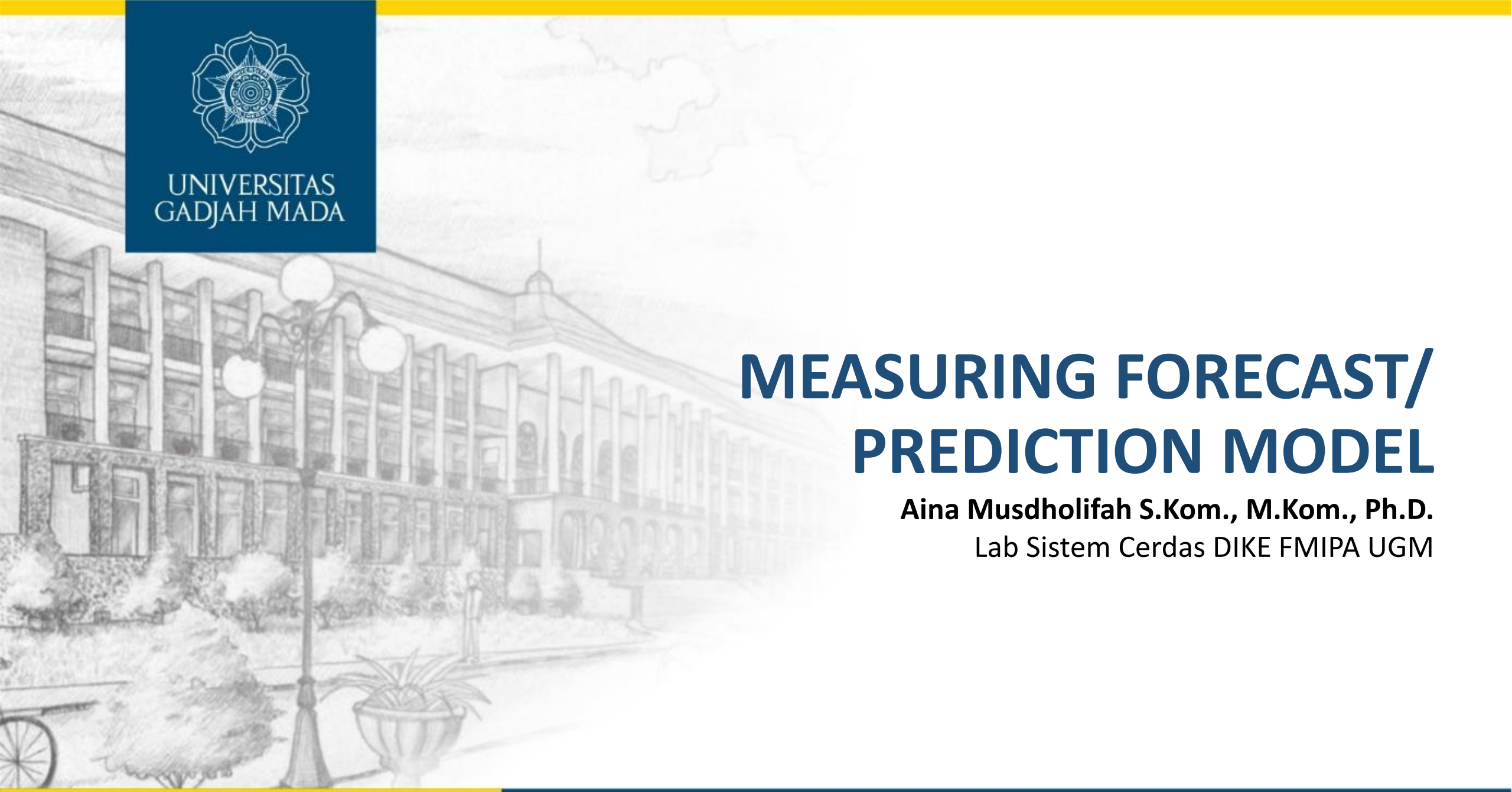
- In the first plot, mean varies (increases) with time which results in an upward trend.
- In the second plot, no trend in the series, but the variance of the series is a vary over time.
- In the third plot, the spread becomes closer as the time increases, which means that the covariance is varying over time.

Stationary: Stationarity means that the statistical properties of a time series which are **mean, variance** and **covarianc e** do not change over time.

Time Series Forecasting Methods

- ARIMA (autoregressive integrated moving average)
- RNN/LSTM (Recurrent Neural Network/Long Short Term Memory)





MEASURING FORECAST/ PREDICTION MODEL

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Intro

- Forecasts and Prediction are never perfect
- Need to know how much we should rely on our chosen forecasting/prediction method/model
- Measuring forecast error:

$$\mathbf{E_t = A_t - F_t}$$

- Note that:

  over-forecasts = negative errors

  and

  under-forecasts = positive errors

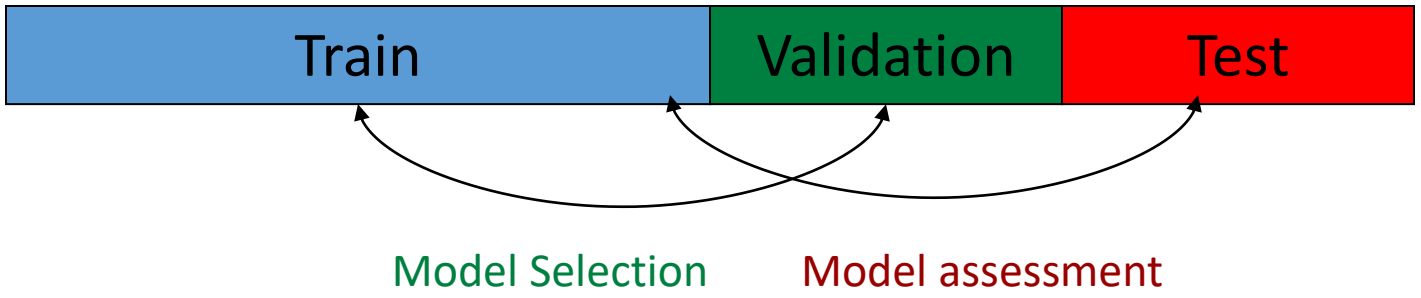
Model Selection and Assessment

- Model Selection: Estimating performances of different models to choose the best one (produces the minimum of the test error)

- Model Assessment: Having chosen a model, estimating the prediction error on new data

Why Errors

- Why do we want to study errors?
- In a data-rich situation split the data:



- But, that's not usually the case

- Errors
  - Measurement of errors (Loss functions)
  - Decomposing Test Error into Bias & Variance

- Estimating the true error
  - Estimating in-sample error (analytically **)**
    AIC, BIC, MDL, SRM with VC
  - Estimating extra-sample error (efficient sample reuse)
    Cross Validation & Bootstrapping

Measuring Errors: Loss Functions

- **Loss function**: measures the error between actual value (A_i) and the predicted value (F_i)

- Typical regression loss functions
  - Squared error: $L(A, F) = (A \quad - F \quad)^2$
  - Absolute error: $L(A, F) = |A - F|$

- Typical classification loss functions
  - 0-1 Loss: $L(A, F) = I(A \neq F)$
  - Log-likelihood (*cross-entropy loss / deviance)*: $L(A, F) = -2 \log pF$

Measuring Errors: Decomposing Test Error

- Test error (generalization error): the average loss over the test set
  - Mean absolute error: $\frac{\sum_{i=1}^{n}|A_i - F_i|}{n}$
  - Mean squared error: $\frac{\sum_{i=1}^{n}(A_i - F_i)^2}{n}$
  - Relative absolute error: $\frac{\sum_{i=1}^{n}|A_i - F_i|}{\sum_{i=1}^{n}|A_i - \bar{A}|}$
  - Relative squared error: $\frac{\sum_{i=1}^{n}(A_i - F_i)^2}{\sum_{i=1}^{n}(A_i - \bar{A})^2}$
- The mean squared-error exaggerates the presence of outliers
- Popularly use (square) root mean-square error, similarly, root relative squared error

Estimating extra-sample error

- Holdout method
  - Given data is randomly partitioned into two independent sets
    - Training set (e.g., 2/3) for model construction
    - Test set (e.g., 1/3) for accuracy estimation
  - Random sampling: a variation of holdout
    - Repeat holdout k times, accuracy = avg. of the accuracies obtained

- Cross-validation (*k*-fold, where k = 10 is most popular)
  - Randomly partition the data into *k mutually exclusive* subsets, each approximately equal size
  - At *i*-th iteration, use D_i as test set and others as training set
  - Leave-one-out: k folds where k = # of tuples, for small sized data
  - Stratified cross-validation: folds are stratified so that class dist. in each fold is approx. the same as that in the initial data

Estimating extra-sample error: Bootstrap

- Bootstrap
  - Works well with small data sets
  - Samples the given training tuples uniformly *with replacement*
    - i.e., each time a tuple is selected, it is equally likely to be selected again and re-added to the training set
- Several boostrap methods, and a common one is **.632 boostrap**
  - Suppose we are given a data set of d tuples. The data set is sampled d times, with replacement, resulting in a training set of d samples. The data tuples that did not make it into the training set end up forming the test set. About 63.2% of the original data will end up in the bootstrap, and the remaining 36.8% will form the test set (since $(1 - 1/d)^d \approx e^{-1} = 0.368$)
  - Repeat the sampling procedue k times, overall accuracy of the model:

$$acc(M) = \sum_{i=1}^{k} (0.632 \times acc(M_i)_{test\_set} + 0.368 \times acc(M_i)_{train\_set})$$

References

- Han and Kamber, 2006, “Data Mining: Concepts and Techniques”.
- Li, 2007, “Model Assessment and Selection”.
- Reid and Sanders, 2010, “Operation Management”.

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HASIL PREDIKSI JUMLAH KASUS COVID-19

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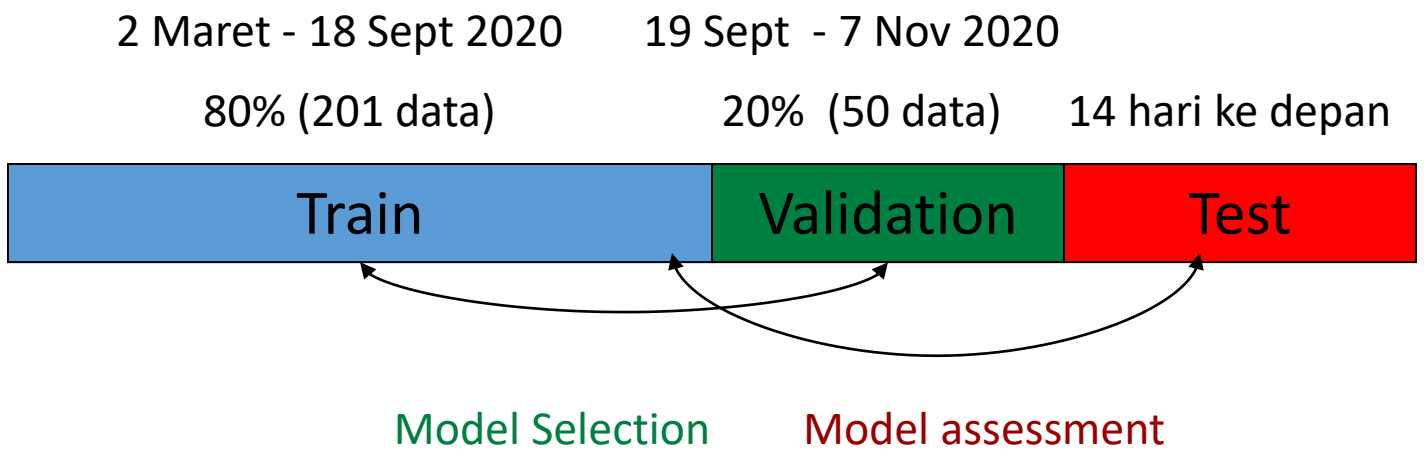
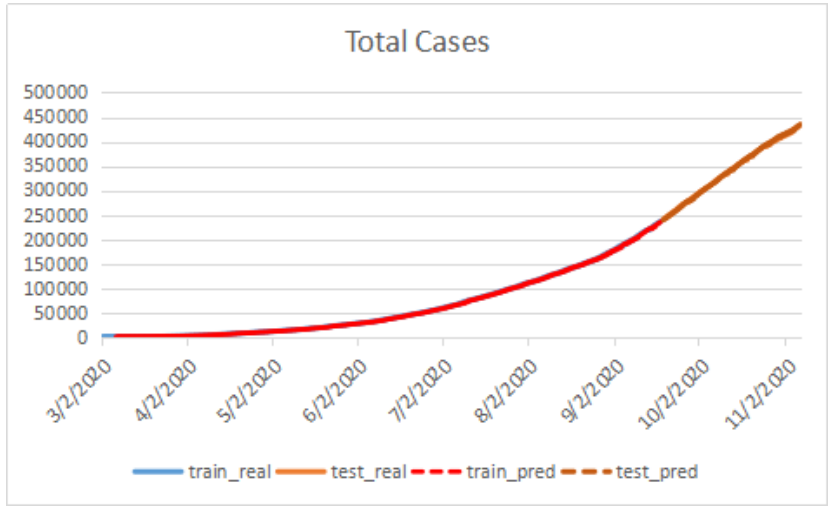
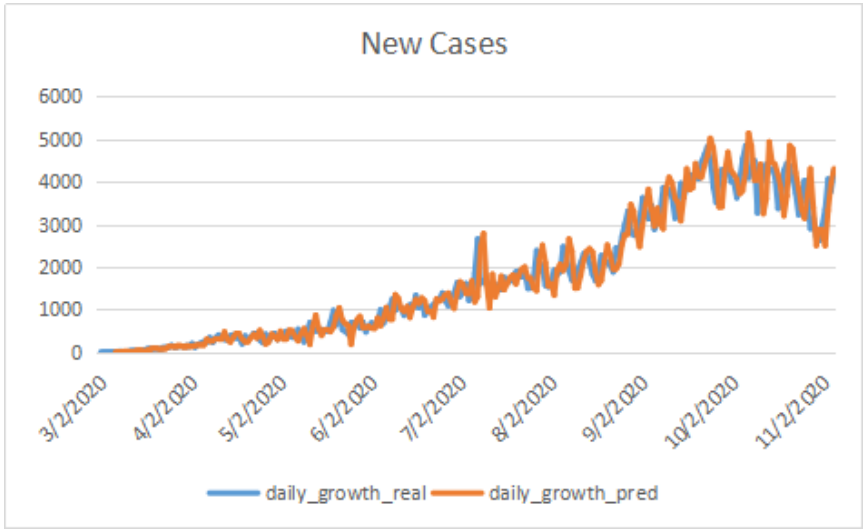
Pembagian
Data Training, Validasi dan Testing



Hasil Prediksi Total Kasus COVID-19 Data Training dan Validasi





MAPE = 0,31 %

$$MAPE = \frac{1}{n}\sum_{t=1}^{n}\left|\frac{V(t) - P(t)}{V(t)} * 100\right|$$

MAPE	Forecasting power
<10%	Highly accurate forecasting
10%~20%	Good forecasting
20%~50%	Reasonable forecasting
>50%	Weak and inaccurate forecasting

Source: Lewis (1982)

Hasil Prediksi Total Kasus COVID-19 14 hari ke depan

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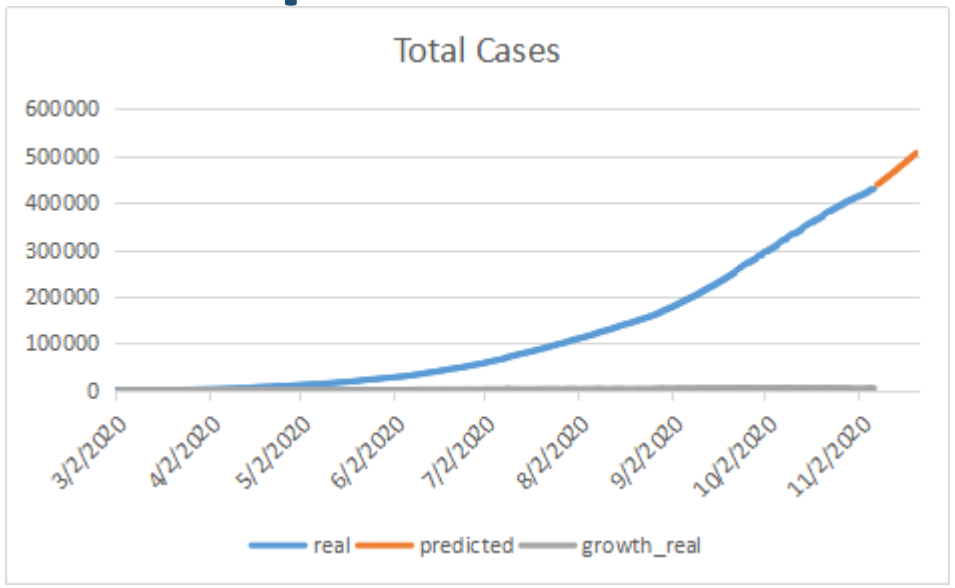

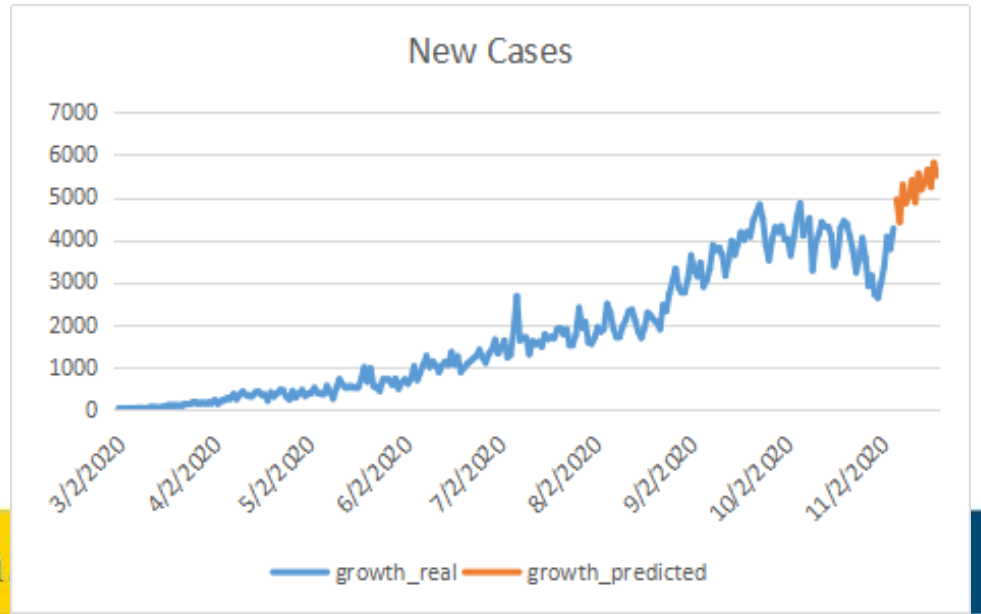

Day	#total case	#new case
8-Nov-2020	438779	4943
9-Nov-2020	443193	4414
10-Nov-2020	448486	5293
11-Nov-2020	453347	4861
12-Nov-2020	458385	5038
13-Nov-2020	463788	5403
14-Nov-2020	468671	4883
15-Nov-2020	474232	5561
16-Nov-2020	479416	5184
17-Nov-2020	484767	5351
18-Nov-2020	490412	5645
19-Nov-2020	495654	5242
20-Nov-2020	501467	5813
21-Nov-2020	506976	5509

Beberapa hal ...

Day	#total case (predicted)	#new case (predicted)	#new case (real)
8-Nov-2020	438779	4943	3880
9-Nov-2020	443193	4414	2853
10-Nov-2020	448486	5293	3779
11-Nov-2020	453347	4861	4173
12-Nov-2020	458385	5038	
13-Nov-2020	463788	5403	
14-Nov-2020	468671	4883	
15-Nov-2020	474232	5561	
16-Nov-2020	479416	5184	
17-Nov-2020	484767	5351	
18-Nov-2020	490412	5645	
19-Nov-2020	495654	5242	
20-Nov-2020	501467	5813	
21-Nov-2020	506976	5509	

- Unreported cases ???
- Jumlah testing yang menurun ???
- ...

JANGAN KENDOR,
PROTOKOL KESEHATAN KETAT

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KLASTER PENULARAN COVID-19 DI INDONESIA

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Klaster Covid berdasarkan wilayah kejadian

Klaster COVID-19 yaitu penamaan sekumpulan kasus penyakit menular akibat virus corona yang terhubung oleh satu peristiwa atau lokasi. Suatu peristiwa atau lokasi disebut sebagai klaster apabila telah diketahui menyumbangkan kasus penularan COVID-19 dalam tingkat yang tinggi.

di Indonesia beberapa klaster terbesar penularan atau penyebaran COVID-19 antara lain:

- Klaster Gowa
- Klaster Bandung
- Klaster Cimahi
- Klaster Semarang
- Klaster Surabaya

1. Klaster Gowa

Klaster Gowa bersumber dari kegiatan pengajian yang dilakukan oleh Suatu Jamaah, yang mana dihadiri oleh peserta dari berbagai wilayah di Indonesia dan warga negara asing. Hal ini yang menyebabkan terbentuknya klister penyebaran covid-19.

2. Klaster Bandung

Klaster Bandung ini berasal dari sekolah calon perwiran TNI AD. Berdasarkan data yang valid, sebanyak 1262 orang dari kalangan siswa dan pelatih yang positif covid-19.

3. Klaster Cimahi

Klaster Cimahi juga berasal dari sekolah militer, yaitu di Pusat Pendidikan Polisi Militer (PUSDIKPOM) Kodiklat TNI AD. Sebanyak 101 kasus positif covid-19 dalam klister ini.

4. Klaster Semarang

Klaster Semarang terjadi di lingkungan perusahaan, yaitu : perusahaan Garmen, Migas dan BUMN. Dari hasil pelacakan petugas menemukan ada sekitar 300 orang yang terkena covid.

Dari kasus ini menambah deretan kasus yang terjadi di industri sebesar 33%, dari tadinya 500,600, menjadi 800 kasus

5. Klaster Surabaya

Klaster Surabaya terjadi dilingkungan pelatihan petugas haji dan lingkungan tempat kerja. sebanyak 157 kasus terjadi yang mana Sebagian besar dari pejabat kementrian Agama.

Klaster COVID-19 berdasarkan lokasi kejadian:

1. Klaster Perkantoran
2. Klaster Rumah Makan
3. Klaster Keluarga
4. Klaster Pasar
5. Klaster Pemukiman
6. Klaster Gowes

1. Klaster Perkantoran

Menurut Prof Wiku, munculnya klaster perkantoran dapat berasal dari pemukiman atau bahkan dalam perjalanan menuju kantor.

Klaster Perkantoran ini terjadi karena adanya salah satu pegawai kantor yang mengidap covid 19 yang mereka bawa baik dari lingkungan rumah, perumahan maupun tertular saat berada di jalan menuju ke tempat kerja.

2. Klaster Rumah Makan

Klaster rumah makan ini bisa terjadi karena adanya salah satu karyawan atau pengunjung yang mengidap covid 19 sehingga menularkan ke setiap pembeli ataupun pegawai yang berinteraksi dengan mereka.

3. Klaster Keluarga

Klaster keluarga ini terjadi karena adanya salah satu anggota keluarga yang mengidap covid 19 namun terlambat di tangani, mungkin karena tidak adanya gejala fisik pada orang tersebut. Hal ini terjadi di beberapa wilayah seperti di Bogor, Bekasi, Yogyakarta, Semarang, dan Malang mulai melaporkan adanya kasus transmisi Corona antar anggota keluarga.

4. Klaster Pasar

Klaster Pasar ini terjadi karena adanya kontak antara pembeli dengan pedagang, yang mana salah satu diantara mereka sudah terkena covid 19. kasus seperti ini banyak terjadi dipasar-pasar tradisional, seperti yang terjadi di Jakarta pada bulan juni sebanyak 52 pedagang yang tersebar di lima pasar tradisional terkena covid 19. kasus lain juga terjadi dipasar tradisional padang raya, sebanyak 113 kasus pedagang yang terkena covid 19.

5. Klaster Pemukiman (Lokal Transmisi)

Klaster pemukiman juga menjadi penyumbang kasus positif covid 19 terbesar di provinsi DKI Jakarta dan Jawa Timur. Hal ini terjadi dari adanya salah satu anggota keluarga yang kena covid 19 kemudian menularkan ke keluarga yang lain, lalu melakukan interaksi dilingkungannya sehingga mempercepat penyebarannya.

6. Klaster Gowes

Klaster gowes ini terjadi karena adanya tren bersepeda saat pandemic ini terjadi, hal ini yang mengakibatkan banyaknya kerumunan kemunitas gowes yang mengakibatkan percepatan penyebaran covid 19 ini. Beberapa waktu lalu, 21 tenaga kesehatan di RSUD Ngudi Waluyo, Wlingi, Blitar, positif virus Corona. Mereka diduga tertular virus Corona dari komunitas gowes.

Perkembangan Kasus Covid-19 Indonesia

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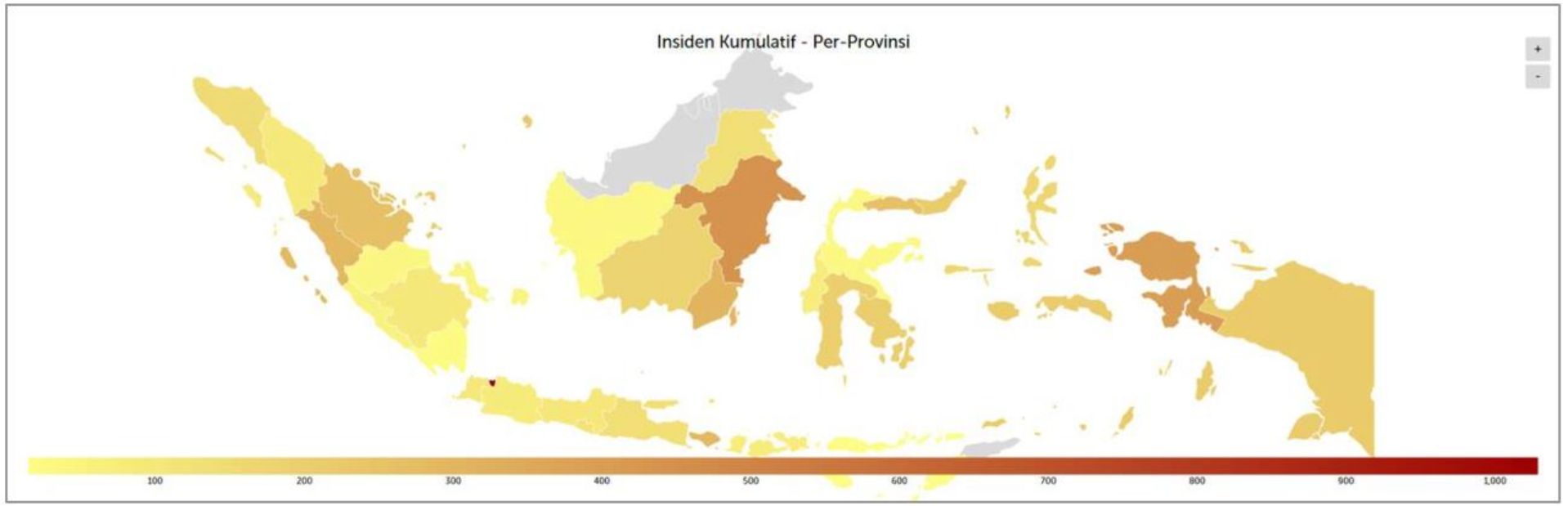
Insidensi Kumulatif Per 100,000 Penduduk Berdasarkan Provinsi



Update Data: 08 November 2020

Top 5 Provinsi dengan Insiden Kasus Tertinggi:
1. **DKI Jakarta** (1,032.87 Per 100,000 Penduduk)
2. **Kalimantan Timur** (439.33 Per 100,000 Penduduk)
3. **Papua Barat** (394.58 Per 100,000 Penduduk)
4. **Kalimantan Selatan** (302.66 Per 100,000 Penduduk)
5. **Bali** (290.24 Per 100,000 Penduduk)

Top 5 Provinsi dengan Insiden Kasus Terendah:
1. **Nusa Tenggara Timur** (14.38 per 100,000 penduduk)
2. **Lampung** (23.80 per 100,000 penduduk)
3. **Sulawesi Tengah** (35.42 per 100,000 penduduk)
4. **Kalimantan Barat** (36.68 per 100,000 penduduk)
5. **Jambi** (37.96 per 100,000 penduduk)

Perkembangan Kasus Covid-19 Indonesia

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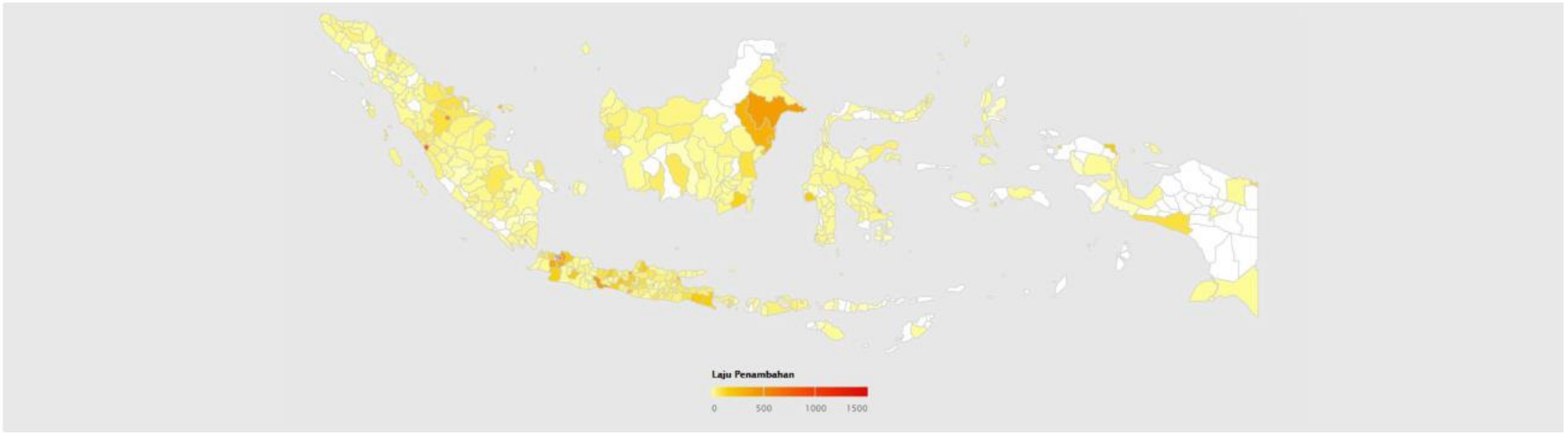
Jumlah Kasus Kumulatif Tertinggi & Terendah serta Jumlah Kasus Aktif di 514 Kabupaten/Kota Indonesia



Update Data: 08 November 2020

Top 10 Dengan Jumlah Kasus Terbanyak	
KOTA ADM. JAKARTA TIMUR	20,549
KOTA ADM. JAKARTA SELATAN	18,198
KOTA ADM. JAKARTA PUSAT	17,707
KOTA ADM. JAKARTA BARAT	17,588
KOTA SURABAYA	16,315
KOTA ADM. JAKARTA UTARA	13,832
KOTA SEMARANG	10,660
KOTA PADANG	9,142
KOTA MAKASSAR	8,756
KOTA PEKANBARU	7,986

Top 10 Dengan Jumlah Kasus Terendah	
PAKPAK BHARAT	1
LUAR PROVINSI	1
LUAR PROVINSI	1
OGAN KOMERING ULU SELATAN	1
LINGGA	1
LUAR PROVINSI	1
LUAR PROVINSI	1
KUPANG	1
LEMBATA	1
MANGGARAI TIMUR	1

6.2%
32 Kab/Kota dengan tidak ada kasus aktif COVID-19

23.7%
122 Kab/Kota dengan ≤10 kasus aktif COVID-19

35.2%
181 Kab/Kota dengan 11-50 kasus aktif

13.8%
71 Kab/Kota dengan 51-100 kasus aktif

19.1%
98 Kab/Kota dengan 101-1,000 kasus aktif

1.9%
10 Kab/Kota dengan >1,000 kasus aktif

www.covid19.go.id 119 +6281133399000 @lawancovid19_

Referensi

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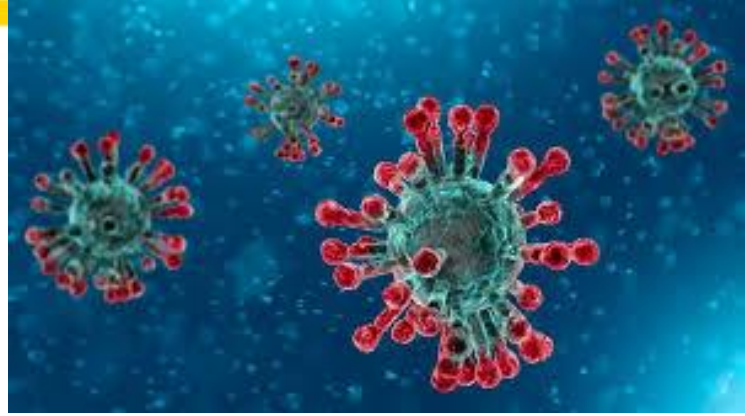

EDUKASI PROTOKOL KESEHATAN

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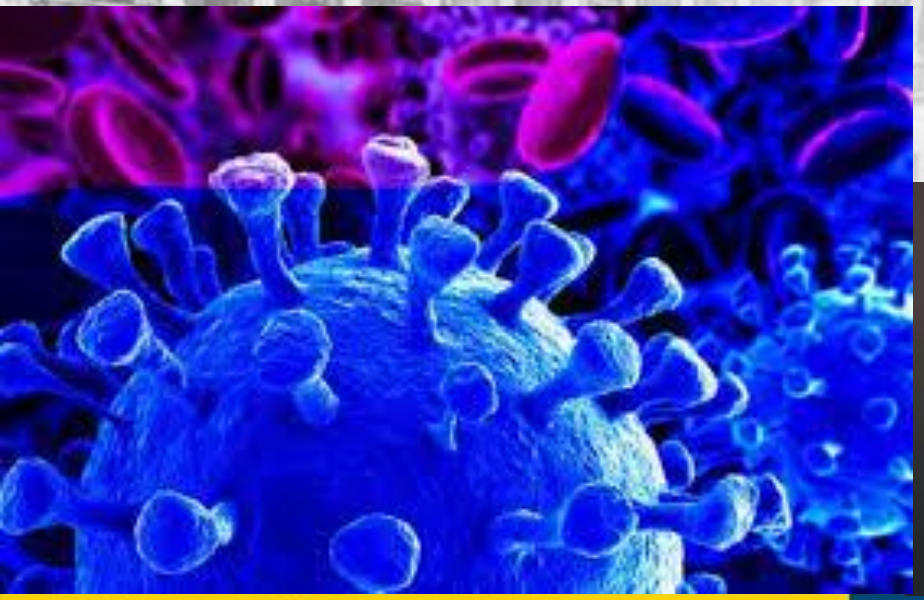

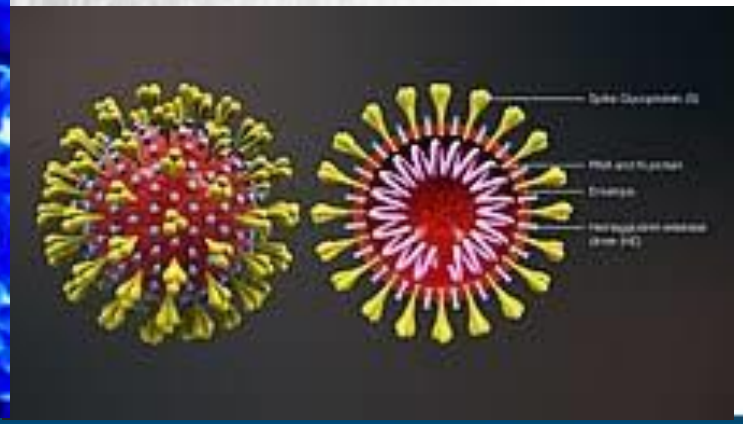

Ibroh dari Peristiwa Pandemi COVID-19

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- Tumbuh Kesadaran betapa manusia merupakan makhluq yang Dhoif

اِنَّ اللّٰهَ لَا يَسْتَحْيٖٓ اَنْ يَّضْرِبَ مَثَلًا مَّا بَعُوْضَةً فَمَا فَوْقَهَا ۗفَاَمَّا الَّذِيْنَ اٰمَنُوْا فَيَعْلَمُوْنَ اَنَّهُ الْحَقُّ مِنْ رَّبِّهِمْ ۚ وَاَمَّا الَّذِيْنَ كَفَرُوْا فَيَقُوْلُوْنَ مَاذَآ اَرَادَ اللّٰهُ بِهٰذَا مَثَلًا ۘ يُضِلُّ بِهٖ كَثِيْرًا وَّيَهْدِيْ بِهٖ كَثِيْرًا ۗوَمَا يُضِلُّ بِهٖٓ اِلَّا الْفٰسِقِيْنَ ۙ - ٢٦

Sesungguhnya Allah tidak segan membuat perumpamaan seekor nyamuk atau yang lebih kecil dari itu. Adapun orang-orang yang beriman, mereka tahu bahwa itu kebenaran dari Tuhan. Tetapi mereka yang kafir berkata, “Apa maksud Allah dengan perumpamaan ini?” Dengan (perumpamaan) itu banyak orang yang dibiarkan-Nya sesat, dan dengan itu banyak (pula) orang yang diberi-Nya petunjuk. Tetapi tidak ada yang Dia sesatkan dengan (perumpamaan) itu selain orang-orang fasik,

- Hendaklah lebih meningkatkan Iman dan Taqwa kepada ALLAH SWT. dengan memperbanyak Ibadah dan ‘Amal Shalih.

Upaya Pencegahan COVID-19

1. **Menggunakan Masker**
   Berdasarkan hasil penelitian Penggunaan masker dapat mencegah 80% penularan COVID-19
2. **Mencuci tangan dengan benar**
   Cuci tangan dengan air mengalir dan sabun, setidaknya selama 20 detik dapat membunuh kuman dan virus. Bagi umat Islam bisa dengan rajin berwudhu.
3. **Menjaga Daya Tahan Tubuh dengan konsumsi gizi seimbang.**
   Seseorang dengan Imunitas yang baik tidak mudah terserang penyakit termasuk COVID-19
4. **Social Destencing atau Menjaga Jarak**
   Dengan Menjaga Jarak minimal 1 M penularan Covid 19 dapat dikendalikan, baik di tempat umum, kendaraan, tempat ibadah, dan tempat-tempat yang memungkinkan berkumpul atau
   bertemu
5. **Disinfeksi barang yang sering dipegang.**
   Virus Corona dapat bertahan hidup selama berjam-jam dan bahkan berhari-hari di permukaan suatu benda.

Memakai Masker dan Mencuci Tangan pakai Sabun

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Menjaga Daya Tahan Tubuh dan Menjaga Jarak

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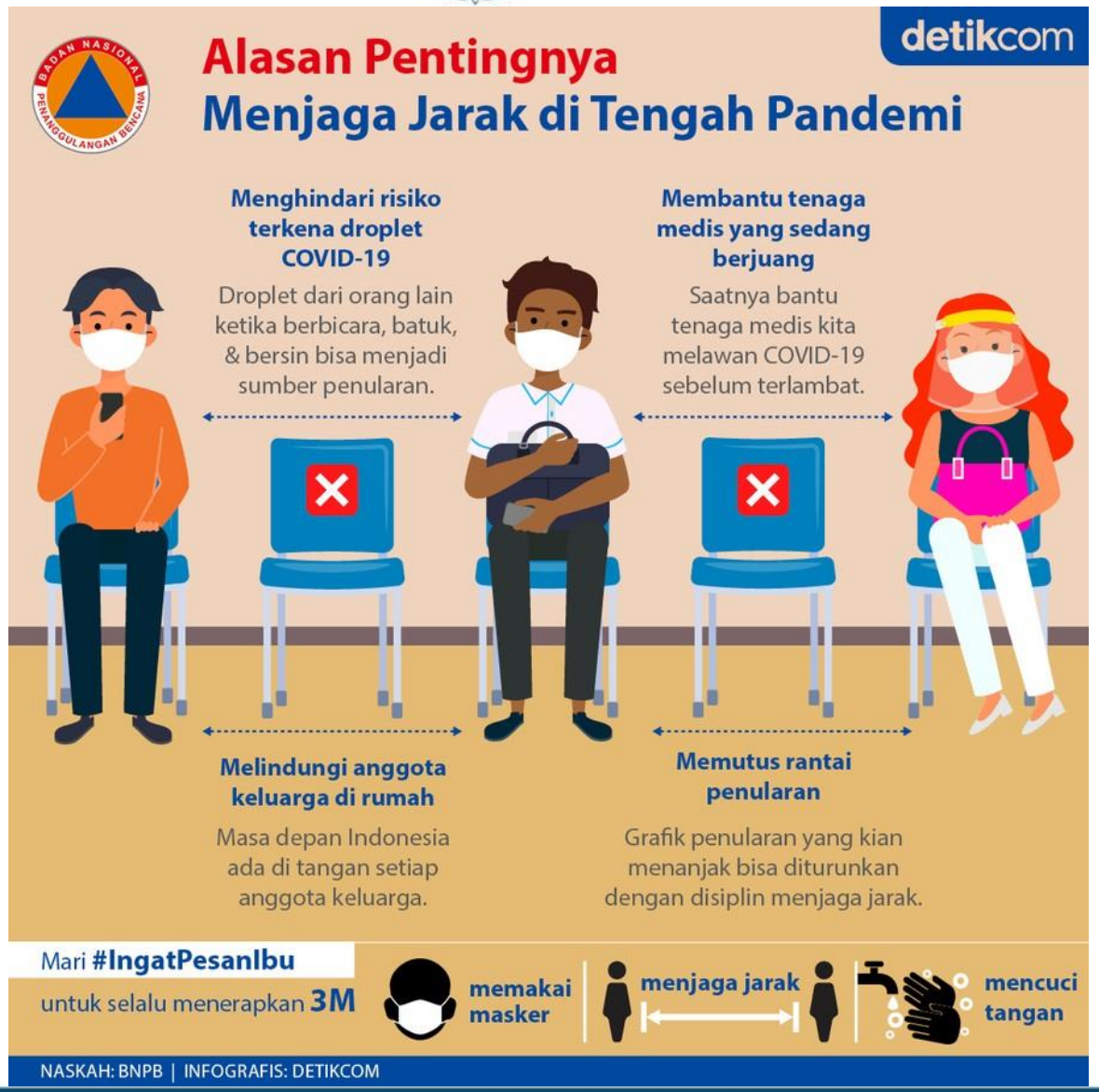


Disinfeksi Barang-barang yang sering dipegang

Pengendalian Covid 19

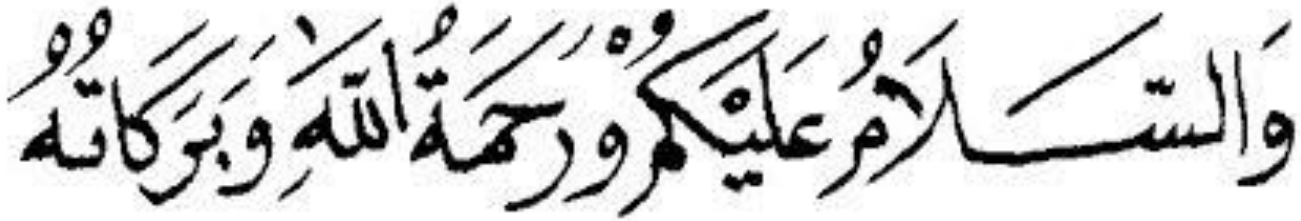
Pemerintah:

- Memperlambat dan menghentikan transmisi/penularan
- Menyediakan pelayanan kesehatan yang optimal untuk pasien
- Meminimalkan dampak dari Pandemi Covid 19 terhadap sistem kesehatan, pelayanan sosial, kegiatan ekonomi, dan kegiatan sektor lainnya.
- Membuat aturan dengan segala sanksinya dalam rangka meminimalkan penularan

Masyarakat:

- Patuh terhadap anjuran Pemerintah
- Menerapkan Perilaku Hidup Bersih dan Sehat
- Pemberdayaan masyarakat melalui satgas penangganan covid 19 baik tingkat RW maupun tingkat Desa (Satgas Jogo Tonggo)

Terima Kasih Atas Perhatiannya,
Mohon MAAF atas segala kekurangan
Dan Salam SEHAT !!



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Safe from Covid-19
Save Our lives

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How to make your environment safer

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- **Avoid the 3Cs: spaces that are closed, crowded or involve close contact.**
  - Outbreaks have been reported in restaurants, choir practices, fitness classes, nightclubs, offices and places of worship where people have gathered, often in crowded indoor settings where they talk loudly, shout, breathe heavily or sing.
  - The risks of getting COVID-19 are higher in crowded and inadequately ventilated spaces where infected people spend long periods of time together in close proximity. These environments are where the virus appears to spreads by respiratory droplets or aerosols more efficiently, so taking precautions is even more important.
- **Meet people outside.** Outdoor gatherings are safer than indoor ones, particularly if indoor spaces are small and without outdoor air coming in.
- **Avoid crowded or indoor settings** but if you can't, then take precautions:
  - **Open a window.** *Increase the amount of* 'natural ventilation' when indoors.
  - **Wear a mask**

Don’t forget the basics of good hygiene

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- **Regularly and thoroughly clean your hands with an alcohol-based hand rub or wash them with soap and water.** This eliminates germs including viruses that may be on your hands.
- **Avoid touching your eyes, nose and mouth.** Hands touch many surfaces and can pick up viruses. Once contaminated, hands can transfer the virus to your eyes, nose or mouth. From there, the virus can enter your body and infect you.
- **Cover your mouth and nose with your bent elbow or tissue when you cough or sneeze**. Then dispose of the used tissue immediately into a closed bin and wash your hands. By following good ‘respiratory hygiene’, you protect the people around you from viruses, which cause colds, flu and COVID-19**.**
- **Clean and disinfect surfaces frequently especially those which are regularly touched,** such as door handles, faucets and phone screens.

What to do if you feel unwell

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- **Know the full range of symptoms of COVID-19.** The most common symptoms of COVID-19 are fever, dry cough, and tiredness. Other symptoms that are less common and may affect some patients include loss of taste or smell, aches and pains, headache, sore throat, nasal congestion, red eyes, diarrhoea, or a skin rash.
- **Stay home and self-isolate even if you have minor symptoms such as cough, headache, mild fever**, until you recover. Call your health care provider or hotline for advice. Have someone bring you supplies. If you need to leave your house or have someone near you, wear a medical mask to avoid infecting others.
- **If you have a fever, cough and difficulty breathing, seek medical attention immediately. Call by telephone first, if you can** and follow the directions of your local health authority.
- **Keep up to date on the latest information from trusted sources, such as WHO or your local and national health authorities.** Local and national authorities and public health units are best placed to advise on what people in your area should be doing to protect themselves.

Save our lives

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