Pengembangan Kecerdasan Buatan dalam Pelayanan Kedokteran

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BIG DATA DAN KEDOKTERAN PRESISI

Species	*T2 phage*	*Escherichia coli*	*Drosophila melanogaster*	*Homo sapiens*	*Paris japonica*
Genome Size	170,000 bp	4.6 million bp	130 million bp	3.2 billion bp	150 billion bp
Common Name	Virus	Bacteria	Fruit fly	Human	Canopy Plant

What is
PRECISION MEDICINE?

DNA "Bases"	4
Bits per Base	2
Haploid Genomes	2
Base **Pairs** per Genome	3 200 000 000
Bits per Base **Pair**	4
Bits per Genome	12 800 000 000
Total Bits (Diploid Genome)	**25 600 000 000**
Total 8-bit Bytes	3 200 000 000
Total Kilobytes (**Kb**)	3 125 000
Total Megabytes (**Mb**)	3 052
Total Gigabytes (**Gb**)	2.980
Assumed coding %	5
Total "Coding" Mb	152.6

Kedokteran presisi merupakan pelayanan kesehatan individu berbasis **genetik, perilaku dan lingkungan**.

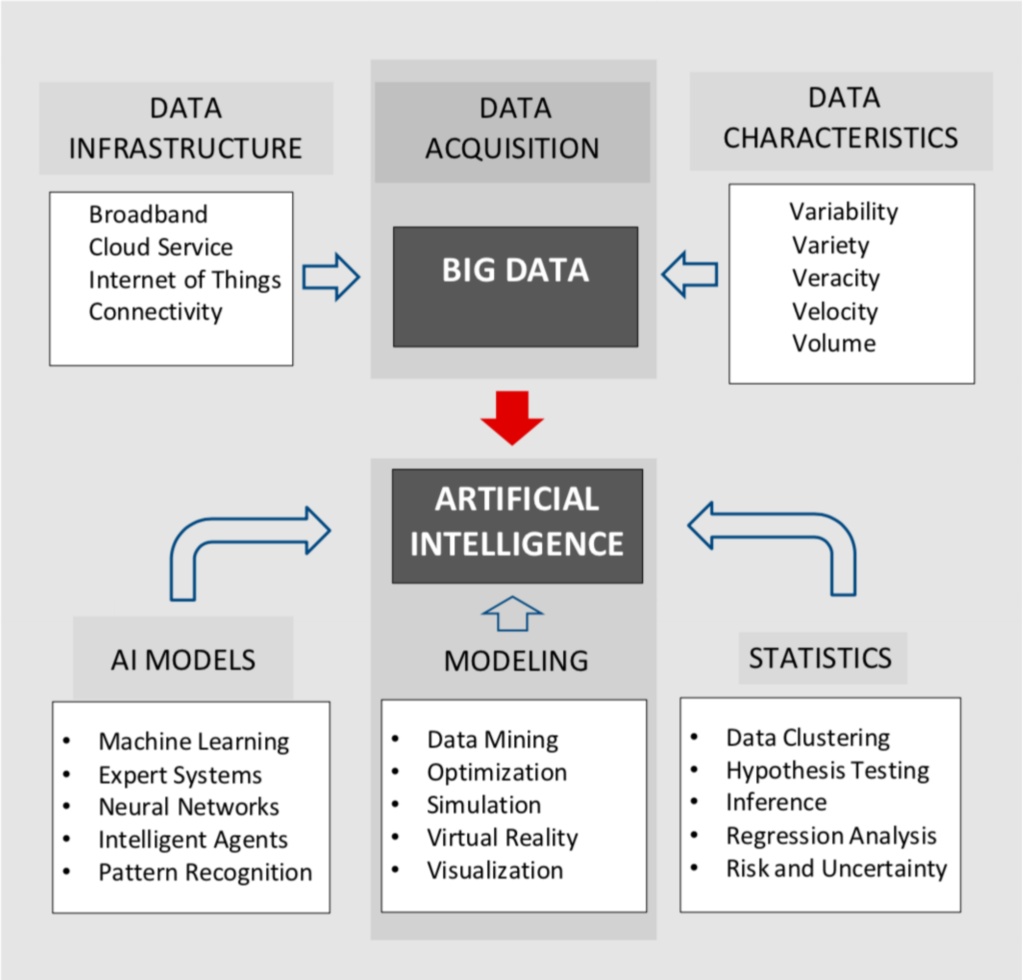
Richard Hodgson

" Perkembangan aspek genetik dan ketersediaan data kesehatan mendorong terwujudnya pelayanan kesehatan individu secara lebih tepat ."

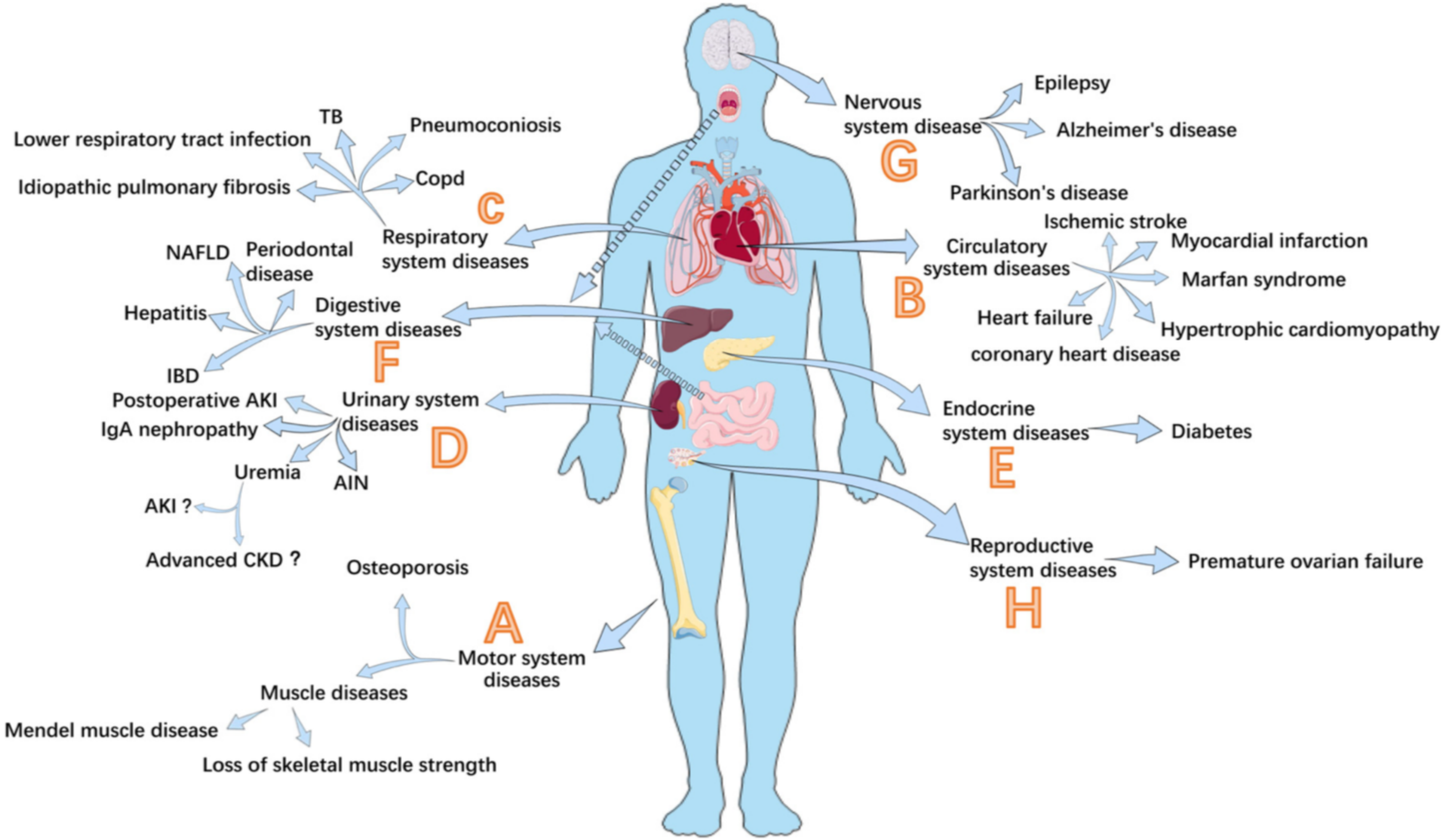
Kecerdasan buatan dan *big data* dalam kesehatan masyarakat

Dampak kombinasi kecerdasan buatan dan *big data* dalam kesehatan sangat besar.

Peran dokter dan tenaga kesehatan sangat penting terhadap **integrasi teknologi dalam pelayanan kesehatan.**



Kurt Benke, Geza Benke. Int. J. Environ. Res. Public Health 2018



Penerapan kedokteran presisi terhadap berbagai penyakit pada manusia

Chan Song et al. Biomedicine and Pharmacotherapy, 2020

REVIEW ARTICLE | FOCUS
https://doi.org/10.1038/s41591-018-0300-7
nature medicine

High-performance medicine: the convergence of human and artificial intelligence

Pemanfaatan kecerdasan buatan dan metode *deep learning* perlu didukung oleh *big data* yang memerlukan **super komputer** dan **penyimpanan data yang besar serta lintas sektoral**.

Kecerdasan buatan bagi **klinisi** akan meningkatkan kecepatan dan akurasi interpretasi gambar, bagi **fasyankes** dapat memperbaiki alur kerja dan mengurangi kemungkinan kesalahan, bagi **pasien** terutama untuk mengolah data kesehatan dirinya yang sangat bermanfaat bagi aspek promotif dan preventif.

Eric J Topol. Nature Medicine, 2019

Continuously Monitoring the Human Machine

Kedokteran presisi akan mendukung **kesehatan presisi** yang memungkinkan individu mengatur perilaku dan lingkungan untuk hidup sehat. Pengumpulan data kesehatan secara **pasif dan terus menerus** merupakan kunci utama dalam aspek kesehatan presisi.

While sleeping

Advances in electrodes small and flexible enough to fit in textiles could lead to pillow- cases and sheets able to monitor brain waves and sleep patterns.

Upon waking

Toilets that check urine and stool for disease are being developed.

In the future, smart mirrors could measure vital signs with radar, and tooth brushes might analyze saliva.

In the kitchen

Smart refrigerators might soon monitor the food stored and record its nutritional information.

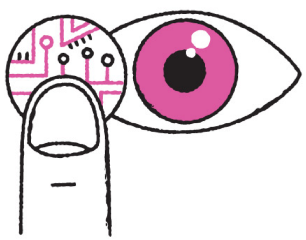
Food quality and freshness would be tracked, along with dietary habits.

Plugged in

Smartphones could analyze patterns that might indicate depression—such as a drop-off in social communication—and alert the user to address potential mental health issues.

In the car

Sensors could warn a driver about dangerous pollution levels, high blood alcohol content detected on the breath, and driving that indicates stress and drowsiness.



In your body

Contact lenses may soon check **pressure and glucose levels** in the eye.

Implantable technologies already monitor cardiac activity, nitrogen, and oxygen levels.

On the run

Electronics like Fitbits or electric membranes attached to the skin can track exercise, vital signs, and ultraviolet exposure, while a **“smart bra”** might detect breast cancer.

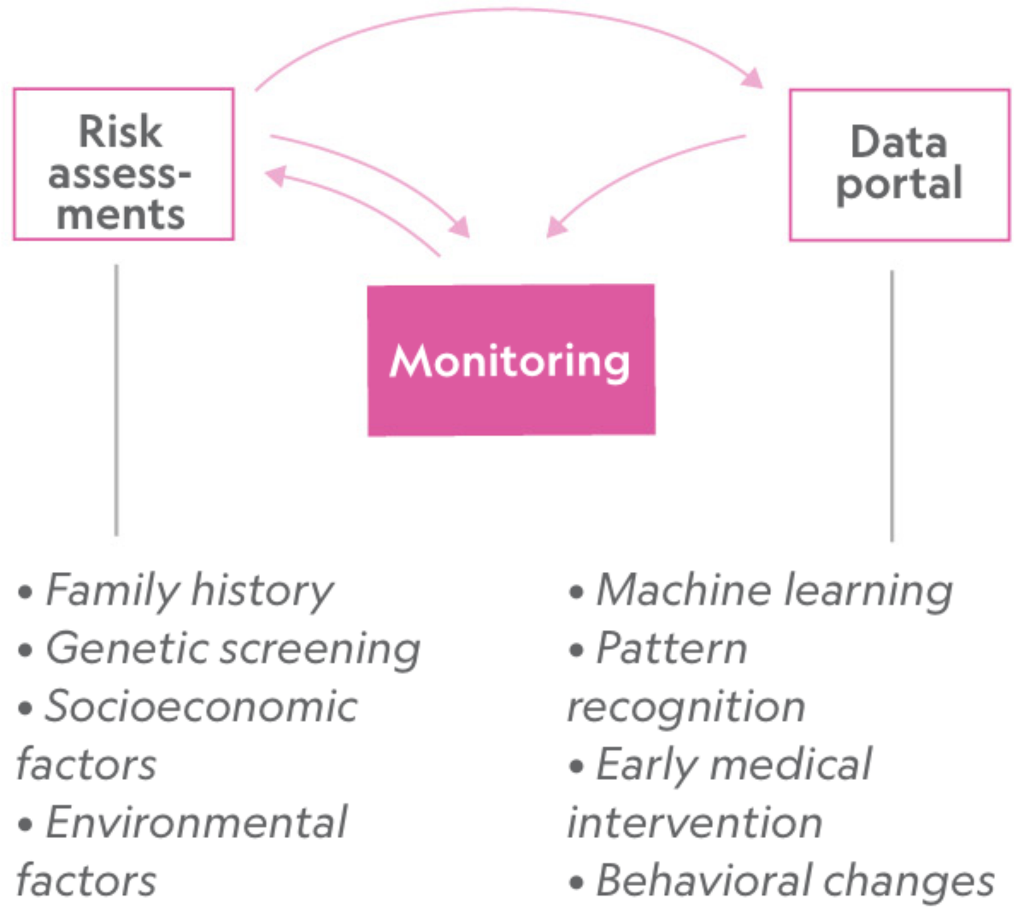
In the lab

“Electronic noses” could detect *volatile organic compounds* **in the breath or in secretions** such as sweat and saliva to find “ smellprints ” of diseases, including lung and ovarian cancer.

A positive feedback loop

Setiap orang akan dinilai faktor risiko serta dibandingkan dengan populasi sehingga dapat **dipilih intervensi yang tepat**.

Pengamatan secara pasif dan terus menerus akan meningkatkan luaran promotif dan preventif.



Manfaat *machine learning* dan **kecerdasan buatan dalam pelayanan kedokteran.**

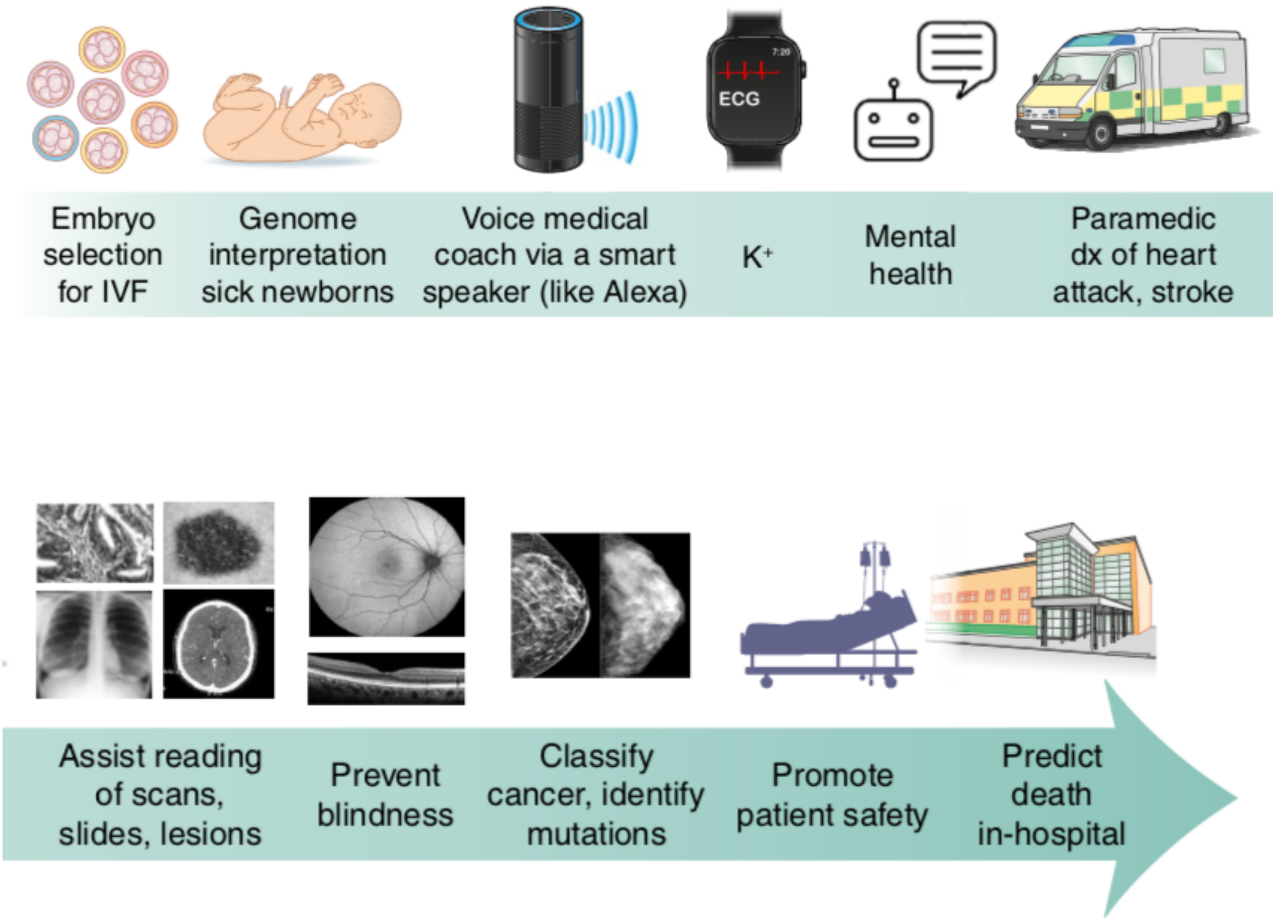
Field	Application
Clinical	Disease prediction and diagnosis
	Treatment effectiveness and outcome prediction
Translation	Drug discovery and repurposing
	(*In Silico*) Clinical trial
Public health	Epidemic outbreak prediction
	Precision health

Nariman et al. Am J Med. 2019

Table 2 | FDA AI approvals are accelerating

Company	FDA Approval	Indication
Apple	September 2018	Atrial fibrillation detection
Aidoc	August 2018	CT brain bleed diagnosis
iCAD	August 2018	Breast density via mammography
Zebra Medical	July 2018	Coronary calcium scoring
Bay Labs	June 2018	Echocardiogram EF determination
Neural Analytics	May 2018	Device for paramedic stroke diagnosis
IDx	April 2018	Diabetic retinopathy diagnosis
Icometrix	April 2018	MRI brain interpretation
Imagen	March 2018	X-ray wrist fracture diagnosis
Viz.ai	February 2018	CT stroke diagnosis
Arterys	February 2018	Liver and lung cancer (MRI, CT) diagnosis
MaxQ-AI	January 2018	CT brain bleed diagnosis
Alivecor	November 2017	Atrial fibrillation detection via Apple Watch
Arterys	January 2017	MRI heart interpretation

Eric J Topol. Nature Medicine, 2019



Penggunaan kecerdasan buatan sesuai siklus kehidupan

Credit: Debbie Maizels/ Springer Nature

Eric J Topol. Nature Medicine, 2019

EBioMedicine 54 (2020) 102710

Contents lists available at ScienceDirect

EBioMedicine

journal homepage: www.elsevier.com/locate/ebiom

ELSEVIER

Research paper

Artificial intelligence-assisted prediction of preeclampsia: Development and external validation of a nationwide health insurance dataset of the BPJS Kesehatan in Indonesia

Check for updates

Herdiantri Sufriyana, MD[a,b], Yu-Wei Wu, PhD[b,a,c], Emily Chia-Yu Su, PhD[a,c,d,*]

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[b] *Department of Medical Physiology, College of Medicine, University of Nahdlatul Ulama Surabaya, Surabaya 60237, Indonesia*
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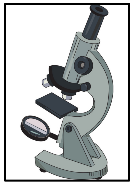
[d] *Research Center for Artificial Intelligence in Medicine, Taipei Medical University, Taipei 11031, Taiwan*

Metode: Seluruh data ibu hamil dalam BPJS Kesehatan diolah menggunakan desain nested case-control menjadi kelompok pre-eklampsia / eclampsia (n = 3318) dan kelompok normotensi (n = 19,883).

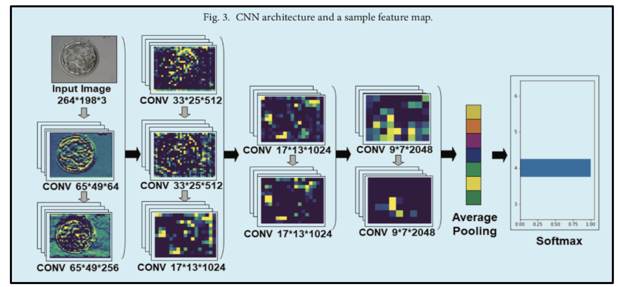
Data yang ada memiliki **95 variabel termasuk data karakteristik dan demografi** serta riwayat kesehatan 24 bulan sebelum onset hipertensi serta melahirkan.

Automated Grading Embryo



Pengambilan 1226 data embrio dari Yasmin IVF, RSCM Kencana

Melakukan *Image Cropping,* dan melakukan *labeling* embrio secara manual



Data citra embrio diproses menggunakan teknologi *deep-learning* dengan arsitektur ResNet50 *Convulotional Neural Network*

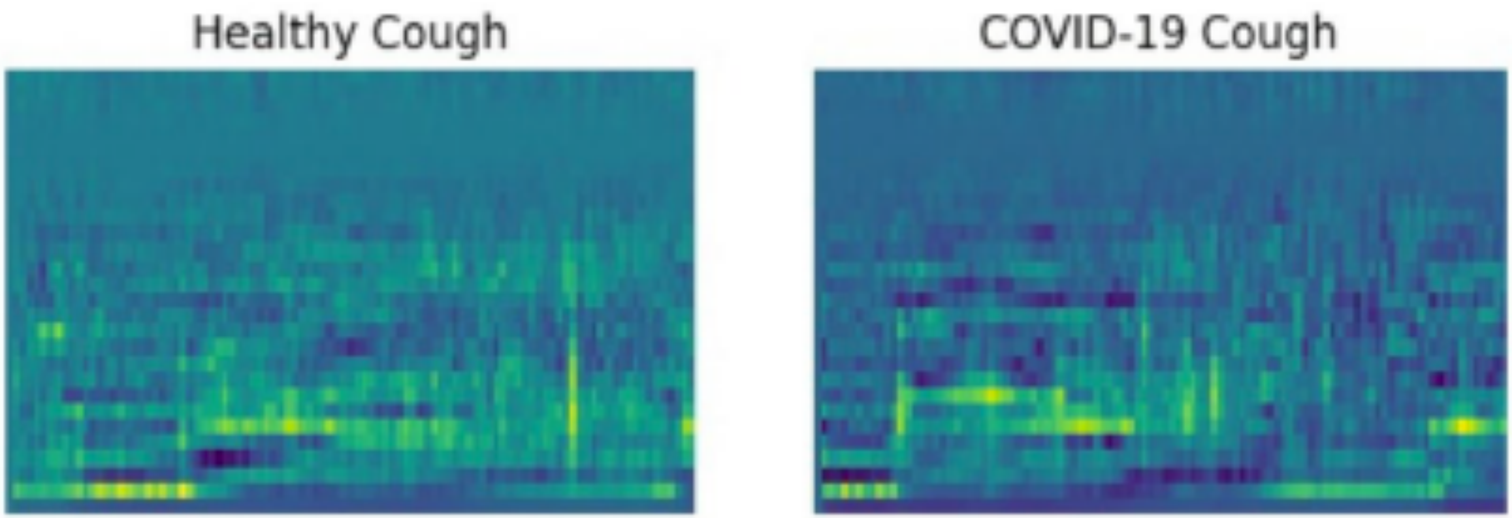
PyTorch

Algoritma yang sudah didapatkan dari proses deep-learning dilatih menggunakan database dari *Fast.AI PyTorch*

Akbar A, Riyati O, Amelia P, Mutia K. Wiweko B. IMERI, 2020

Analisis Suara Napas, Batuk, dan Sesak serta Faktor Risiko pada Pasien COVID-19 di Indonesia Guna Membangun Model *Artificial Intelligence* untuk Aplikasi *Telemedicine* Skrining COVID-19

IMERI

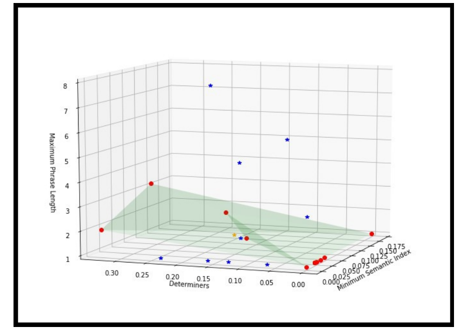


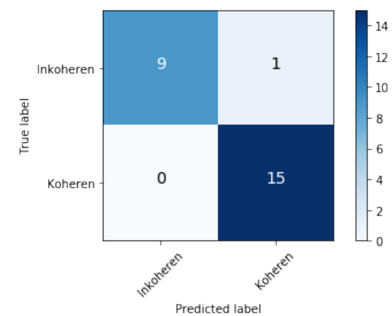
Gambar 1. Hasil Spektrogram Suara Normal dan Suara Batuk[25]

Miranda AV, Ikromi A, Handayani RRD, Yusuf PA, Susilaradeya D, Pujitrsnani A, Yunus RE

Pendanaan: Hibah Pengmas IPTEKS bagi Masyarakat UI 2019&2020

Deteksi Dini Gangguan Jiwa Psikosis pada Remaja Risiko Tinggi dengan Analisis Semantik dan Sintaksis Berbasis Algoritma *Machine-Learning*





Sumber Gambar:
https://previews.123rf.com/images/robuart/robuart1807/robuart180731506/105604144-student-teenagers-collection-boy-holding-laptop-and-smiling-girl-with-book-smiling-young-lady-standi.jpg

Sumber Gambar:
https://www.pantechsolutions.net/blog/wp-content/uploads/2018/06/Machine-learning-workflow.png

Sumber Gambar:
https://ui-ex.com/images/vector-man-infographic-3.png

Khamelia, Wiwie M, Kaligis F, Yusuf PA, Susanto A, Widyarini GAA, Susilaradeya DP, Cynthia LFAR, Pujitresnani A, Lukmana AAI, Ilham PS
Pendanaan: Program Pendanaan Perancangan Dan Pengembangan Purwarupa DISTP UI 2020

In Review | BMC Medical Informatics and Decision Making | BMC Series

RESEARCH ARTICLE *Medical Informatics*

Virtual Screening on Indonesian Herbal Compounds as COVID-19 Supportive Therapy: Machine Learning and Pharmacophore Modeling Approaches

Linda Erlina, Rafika Indah Paramita, Wisnu Ananta Kusuma, Fadilah Fadilah, Aryo Tedjo, Irandi Putra Pratomo, Nabila Sekar Ramadhanti, Ahmad Kamal Nasution, Fadhlal Khaliq Surado, Aries Fitriawan, Khaerunissa Anbar Istiadi, Arry Yanuar

Results

The models yielded by SVM, RF, and MLP were used for screening in herbal compounds obtained from HerbalDB and got 125 potential compounds. Whereas the structure-based pharmacophore modeling gave eight hit compounds and the ligand-based methods produced more than a hundred hit compounds. Based on the screening on HerbalDB using these two prediction approaches, we got 14 hit compounds candidates. Further analysis was done using molecular docking to know the interaction between each compound and main protease of SARS-CoV-2 as inhibitory agents. From molecular docking analysis, we got six potential compounds as the main protease of SARS-CoV-2 inhibitor, i.e Hesperidin, Kaempferol-3,4'-di-O-methyl ether (Ermanin); Myricetin-3-glucoside, Peonidine 3-(4'-arabinosylglucoside); Quercetin 3-(2G-rhamnosylrutinoside); and Rhamnetin 3-mannosyl-(1−2)-alloside.

Conclusions

Herbal compounds from various plants were potential as candidates of SARS-CoV-2 antivirals. Based on our research and literature study, one of the potential commodity crops in Indonesia is *Psidium guajava* (guava) and can be directly used by the community.

KEYWORDS *COVID-19, Machine Learning, Pharmacophore Modeling, Molecular Docking, Indonesian Herbal Compounds, 3CLPro, SARS-CoV-2*

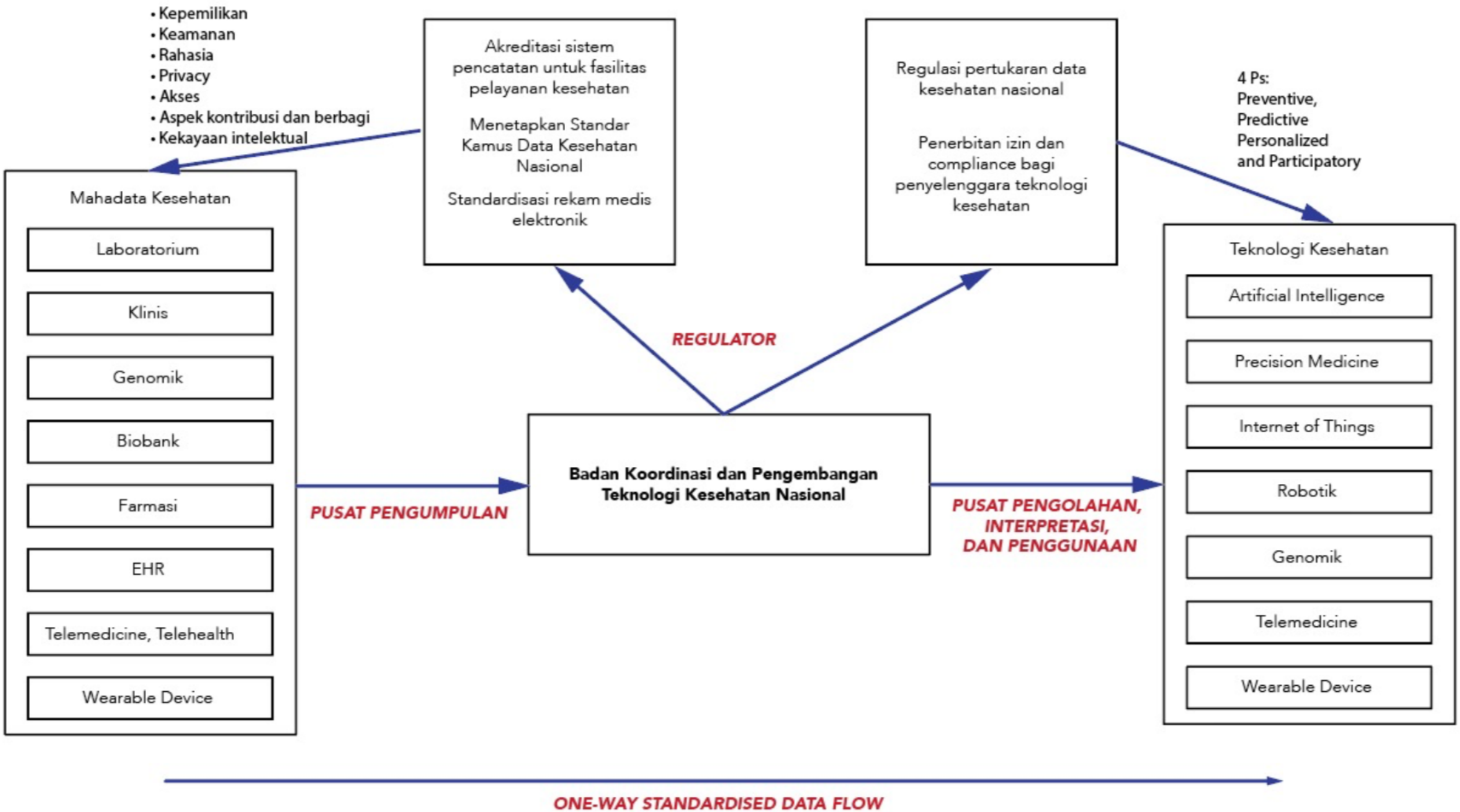
PENGEMBANGAN OBAT BERBASIS GENOMIK

Penggunaan kecerdasan buatan dalam memetakan **potensi genetik biodiversitas Indonesia sebagai obat**

BANK POTENSI GENETIK TANAMAN INDONESIA

mempercepat proses = akselerasi

Ketahanan – Kemandirian Kesehatan Indonesia



Otoritas Data Kesehatan. Wiweko, 2020

TAKE HOME MESSAGES

1. *Big data* yang terdiri dari data individu, genetik, proteomik, metabolomik merupakan **kunci utama** dalam pelayanan kedokteran presisi.

2. Layanan kedokteran presisi sangat membutuhkan dukungan **aspek kesehatan digital** dalam mengumpulkan data, mengawasi dan menentukan risiko individual secara akurat.

3. Teknologi kesehatan dan **kecerdasan buatan** merupakan perantara antara big data dan kedokteran presisi,

4. Potensi teknologi kesehatan digital dalam layanan kedokteran presisi harus didukung oleh **infrastruktur dan dilindungi dengan regulasi kesehatan**.