



# Zastosowania sztucznej inteligencji w erze Covid i post-Covid

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Wspomagania Decyzji

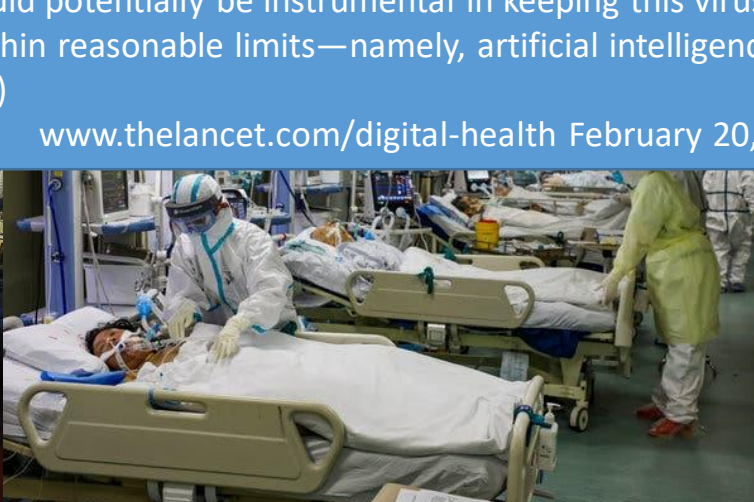


# Pandemia w XXI wieku. Czy coś się zmieniło?



On the frontline, tactical response to COVID-19 is similar to that of SARS but one major difference exists: in the 17 years since SARS, a powerful new tool has emerged that could potentially be instrumental in keeping this virus within reasonable limits—namely, artificial intelligence (AI)

[www.thelancet.com/digital-health](http://www.thelancet.com/digital-health) February 20, 2020





# (Pool) test optimization and scheduling

TIME

GEORGE FLOYD PROTESTS AMERICA'S OVERDUE AWAKENING MINNEAPOLIS BREONNA TAYLOR NEWSLETTER

WORLD • LUXEMBOURG

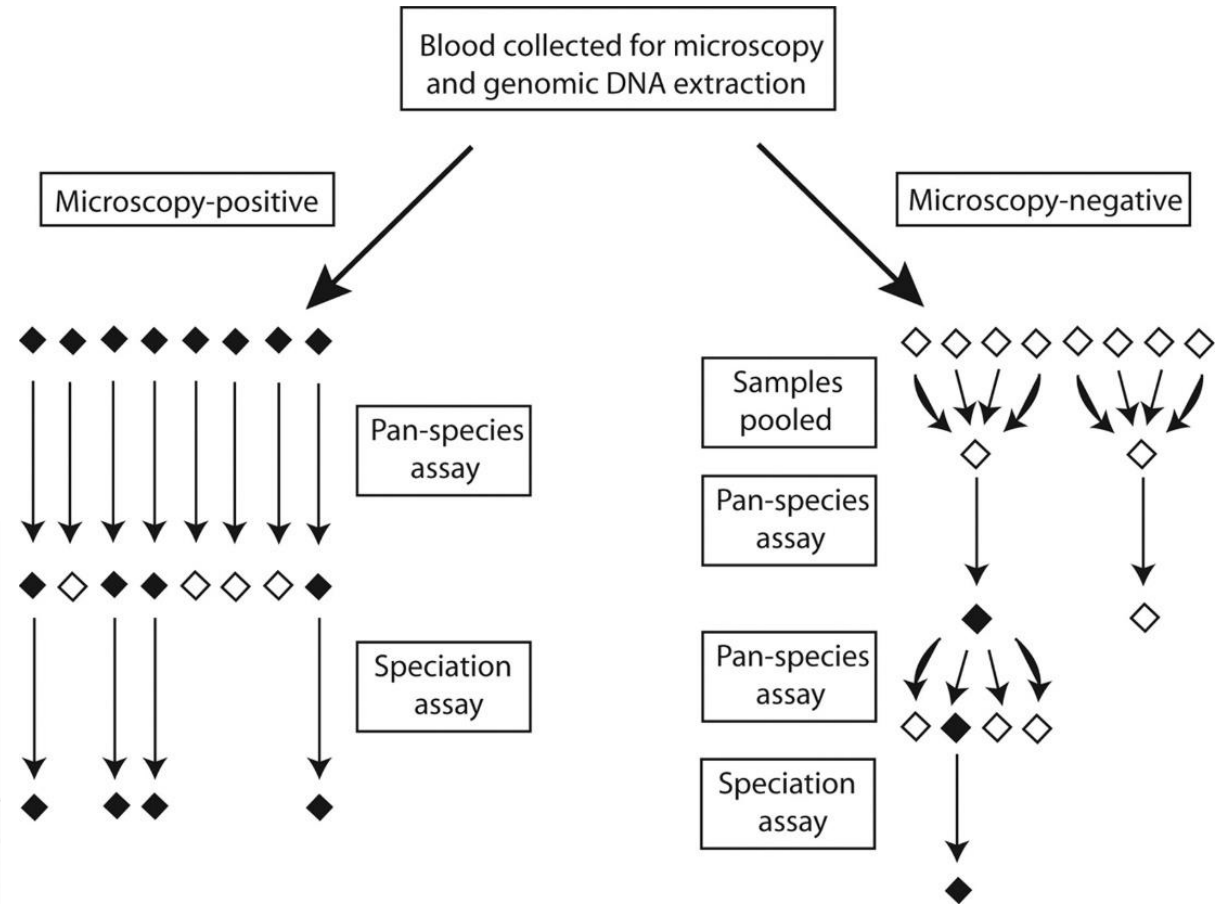
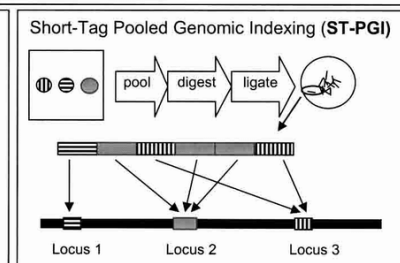
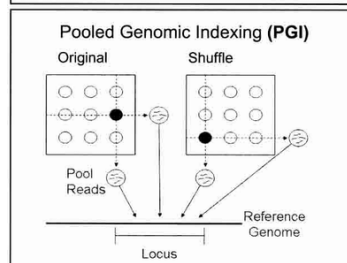
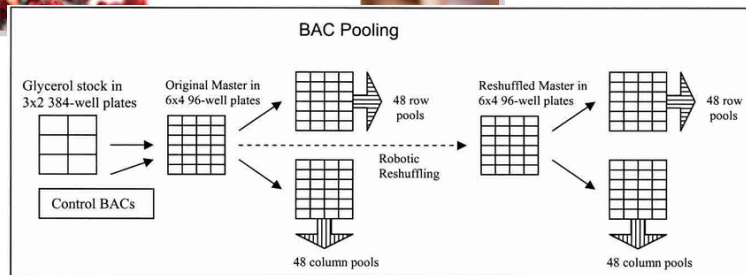
## Luxembourg Expands COVID-19 Testing to Its Entire Population

Nauka w Polsce PAP

### Badacze z Instytutu Nenckiego pracują nad procedurami grupowych testów na koronawirusa

Dodano: 28 kwietnia 2020, 06:55 / +3 -0 / 4362

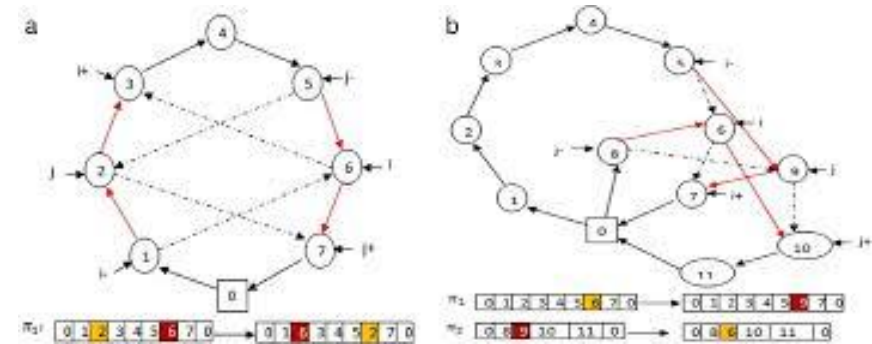
CIKIZYCIA CHOROBY BA





# (Pool) test optimization and scheduling

- Proste modele testów grupowych (z reguły) nie uwzględniają:
  - Efektu rozcieńczania (dilution) – spadek dokładności testów wraz z powiększaniem grupy
  - Heterogeniczności populacji – różne prawdopodobieństwa pozytywnego testu
  - Kryteriów typu minimalizacja false negatives
  - Elastycznych schematów testowania
- Miejsce na inteligentne algorytmy optymalizacji?
- Inne wyzwanie – logistyka testów
  - Często czas ważniejszy od kosztów
  - Np. Skewed vehicle routing problem – minimalizacja łącznego/maksymalnego czasu obsługi klientów

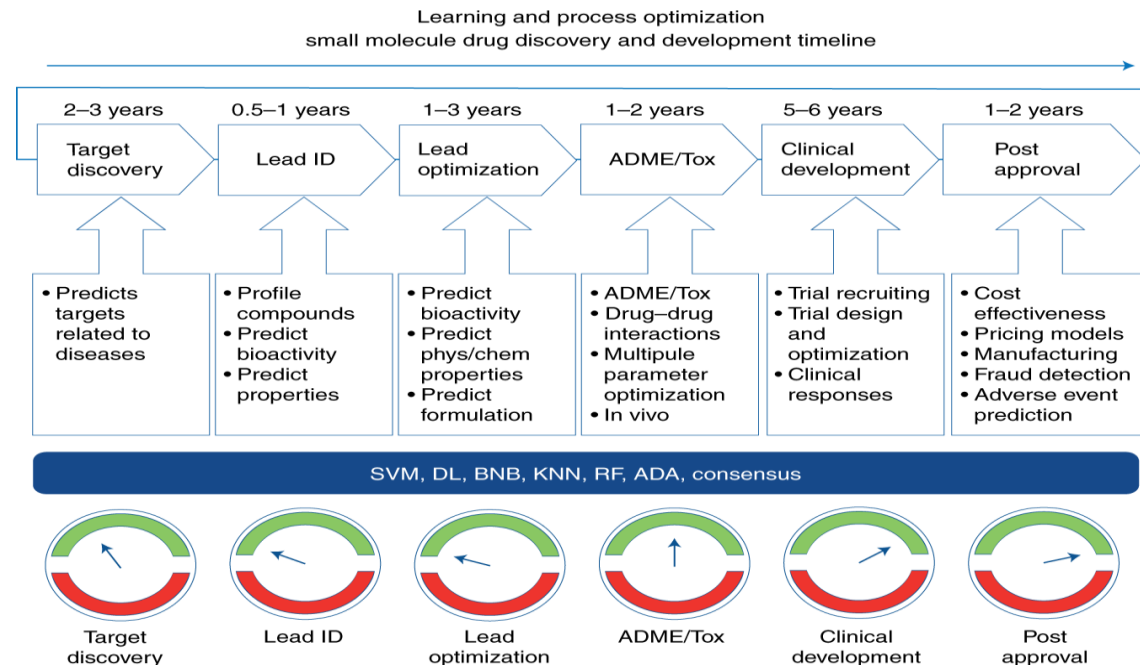




# Drug discovery and development

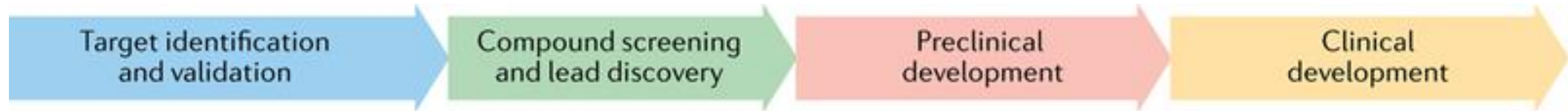
- On average, it takes **at least ten years** for a **new medicine** to complete the journey **from initial discovery to the marketplace**, with clinical trials alone taking six to seven years on average. The average cost to research and develop each successful drug is estimated to be **\$2.6 billion**.

- [http://phrma-docs.phrma.org/sites/default/files/pdf/rd\\_brochure\\_022307.pdf](http://phrma-docs.phrma.org/sites/default/files/pdf/rd_brochure_022307.pdf)





# Drug discovery and development



## Successful applications in drug discovery

- Target identification and prioritization based on gene–disease associations
- Target druggability predictions
- Identification of alternative targets (splice variants)

- Compound design with desirable properties
- Compound synthesis reaction plans
- Ligand-based compound screening

- Tissue-specific biomarker identification
- Classification of cancer drug–response signatures
- Prediction of biomarkers of clinical end points

- Determination of drug response by cellular phenotyping in oncology
- Precise measurements of the tumour microenvironment in immuno-oncology

## Required data characteristics

- Current data are highly heterogeneous: need standardized high-dimensional target–disease–drug association data sets
- Comprehensive omics data from disease and normal states
- High-confidence associations from the literature
- Metadata from successful and failed clinical trials

- Large amounts of training data needed
- Models for compound reaction space and rules
- Gold standard ADME data
- Numerous protein structures

- Biomarkers: reproducibility of models based on gene expression data
- Dimension reduction of single-cell data for cell type and biomarker identification
- Proteomic and transcriptomic data of high quality and quantity

- Pathology: well-curated expert annotations for broad-use cases (cancer versus normal cells)
- Gold standard data sets to improve interpretability and transparency of models
- Sample size: high number of images per clinical trial

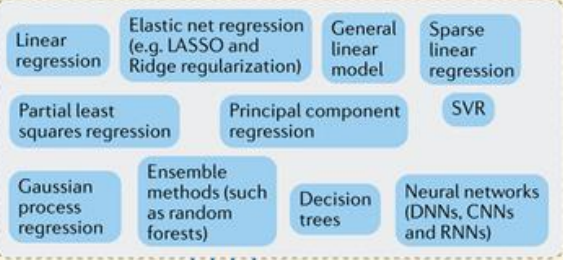


# Drug discovery and development

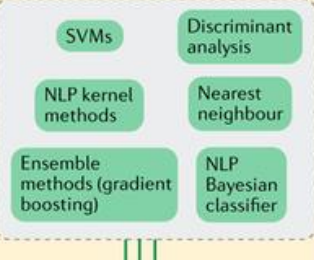
## Supervised learning techniques

## Unsupervised learning techniques

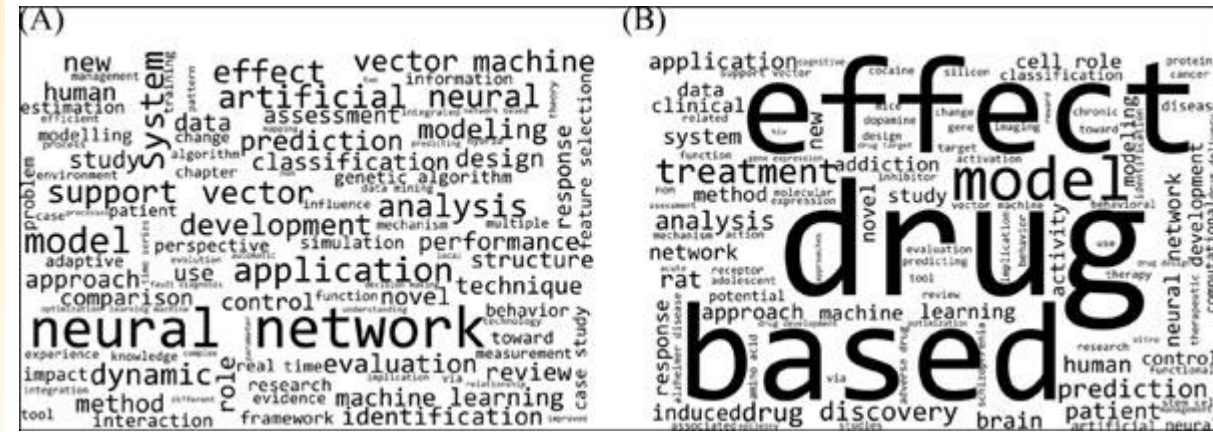
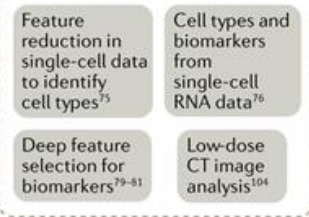
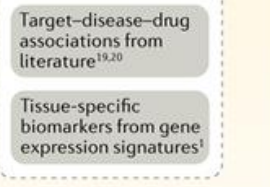
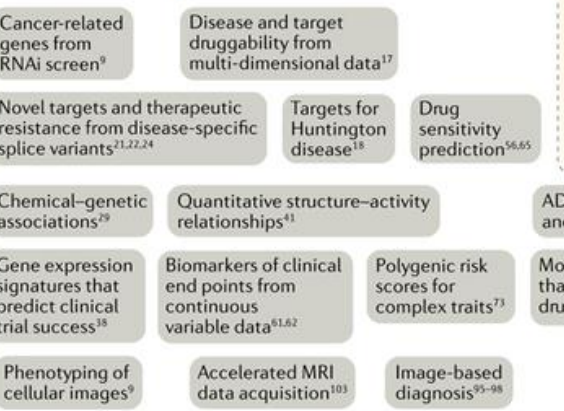
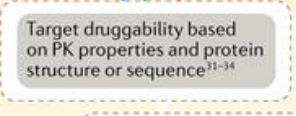
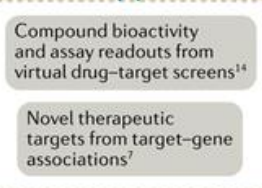
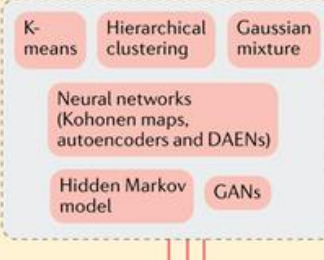
### Regression analysis methods



### Classifier methods



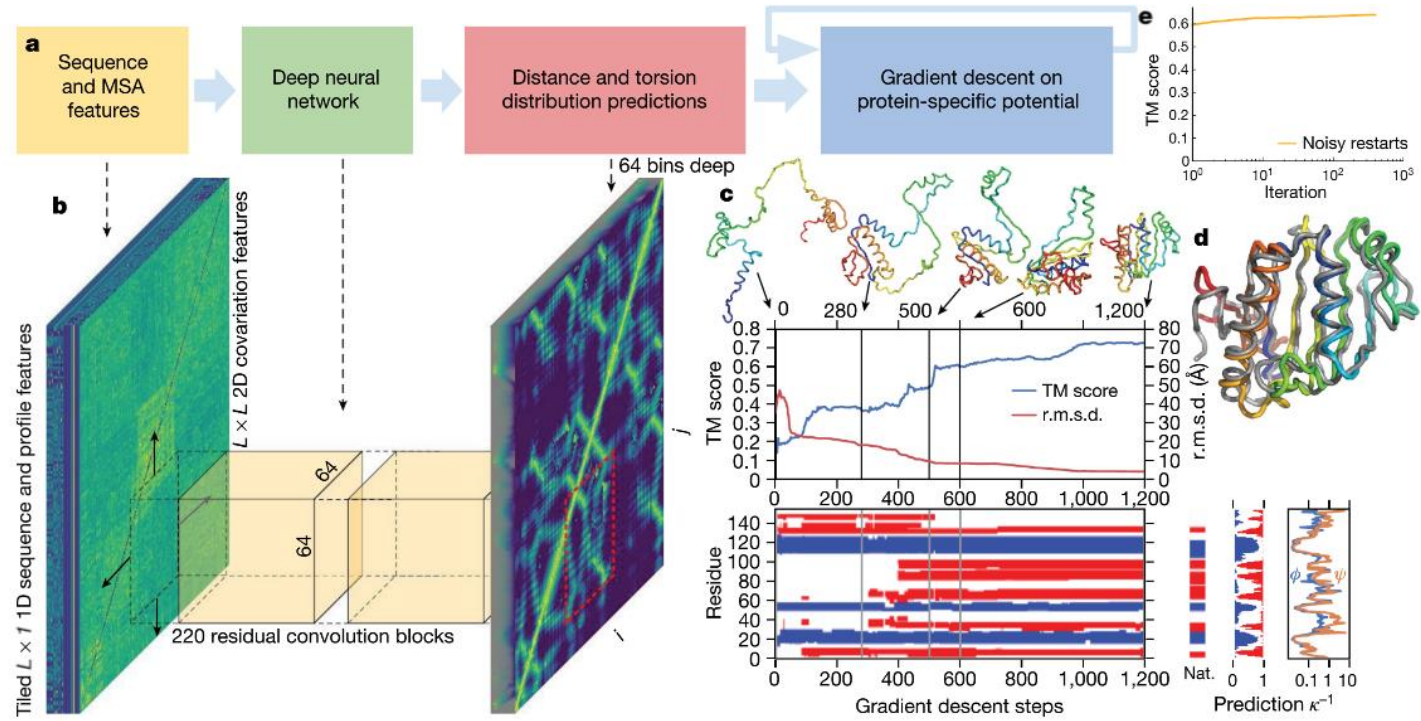
### Clustering methods





# Vaccine development

- E.g. Predictions of the virus structure
- DeepMind AlphaFold



Nature 2019





# Vaccine development

## RNAComposer

Automated RNA Structure 3D Modeling Server

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 Institute of Bioorganic Chemistry, Polish Academy of Sciences

 Institute of Computing Science, Poznan University of Technology

### Welcome to RNAComposer, a fully au

The RNAComposer system offers a new principle and operates on the RNA FRABAS

#### RNAComposer works in two modes:

- interactive mode** - allows to work  
Input your RNA sequence and secondary structure ([Example 1](#) and [Example 2](#)) or sequence only ([Example 3](#)). Example 3 is offered for introductory purposes.
- batch mode** - is designed for large-scale automated modeling of RNA structures up to 500 nt residues, based on user-defined RNA secondary structures. As an input a set of up to 10 RNA sequences can be used. This mode is available only for registered users.

#### You are in interactive mode

Enter RNA sequence and secondary structure in dot-bracket format ([Example 1](#) and [Example 2](#)) or sequence only ([Example 3](#)). A maximum sequence length is limited to 500 residues.

Load example: [1](#) [2](#) [3](#)

```
#HIV-2 DIS RNA hairpin
>example1
GCUCCUAGAAAGGCGCGGGCCGAGGUACCAAGGCAGCGUGUGGAGC
((((.....(((.....))))))..)))))
```

Select secondary structure prediction method

Email results to:

### Już 1 mln razy badacze i osoby z całego świata wykorzystwały RNAComposer – publicznie dostępnym, skutecznym polskim systemem do modelowania struktury 3D RNA. A to nie jedyny polski sukces w badaniach nad wyznaczaniem struktury RNA.



# Rapid diagnosis

- Center for Connected Health Care UG develops and trains an AI-based algorithm for the intermittent measurement of the QT interval from those 'smart' devices: very low energy consuming
- Instituto Tecnológico Informática develops a tool to support healthcare personnel for diagnosis, prognosis and screening to allow early prediction of cases of pneumonia caused by COVID19 by analyzing and processing torax x-ray images
- Neosperience S.p.A. evaluates the feasibility and applicability of the Artificial Intelligence - Machine Learning project to the analysis of pulmonary and cardiac radiographic and ultrasound images, acquired through chest X-ray and pulmonary and echocardiographic transthoracic ultrasound examination at the patient's bed, in the current and contingent COVID emergency- 19
- Bournemouth University. AI method for monitoring and analysing citizens breathing signals using mobile sensing technology in order to early detect those with early symptoms of breathing conditions.
- Sensifai Belgium Automatic detection of Covid-19 in x-ray and CT scan images



# Rapid diagnosis



PL

## Nasza odpowiedź na COVID-19

Zdalne, bezpieczne badania płuc w warunkach domowych wspierane zaawansowaną analizą AI  
#StayHome with StethoMe



[Dowiedz się więcej](#)



Automatyczna analiza dźwięków osłuchowych

## Moduł AI wspierający diagnostykę

System StethoMe® opiera się na medycznych algorytmach sztucznej inteligencji - StethoMe® AI. Dzięki nim system **informuje o pojawieniu się nieprawidłowych dźwięków charakterystycznych dla infekcji dróg oddechowych, zapalenia oskrzeli i płuc, astmy czy POChP.**

StethoMe® AI identyfikuje świsty, fuczzenia, rżenia grubo i drobno-bańkowe. Lekarz zdalnie otrzymuje gotowy raport badania, może również odsłuchać dźwięki i obejrzeć ich analizę graficzną.



# Behavior control

- Reinhold Technik GMBH & Co KG inexpensive camera system that continuously checks the minimum distance between people in shops
- E.ON Digital Technology/ Stanford University **AI-based hand washing coach**
- Landing AI has developed a tool that can track people's locations in real time to see if pedestrians are getting too close to each other.





# Zastosowania AI w erze Covid i post-Covid

- (Pool) test optimization and scheduling
- Drug & Vaccine discovery and development
- Rapid diagnosis
- Behavior control
- AI in Telemedicine
- AI in telework and robotics
- Knowledge sharing
- Early warnings
- Discovery of transmission paths
- Prediction of the evolution of the pandemic
- Misinformation discovery and prevention
- Medical staff scheduling
- Medical staff protection
- Optimization in post-crisis economy