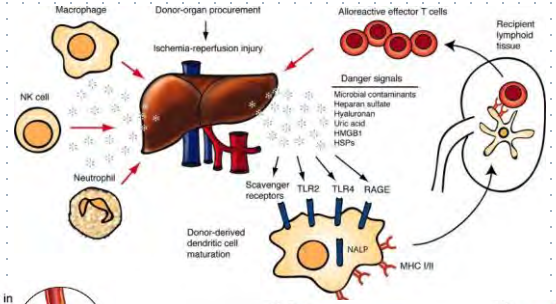
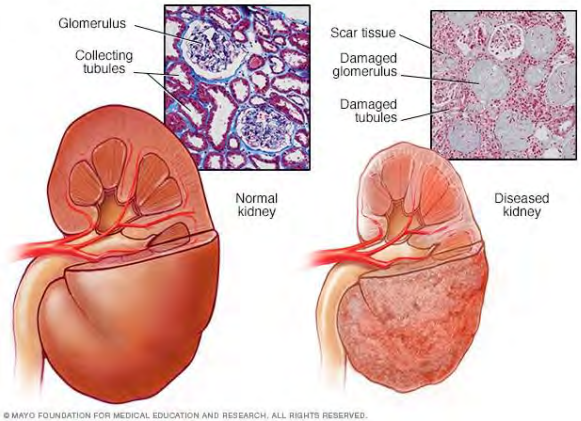
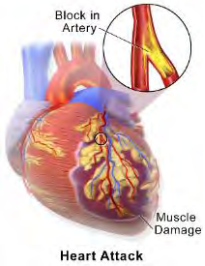
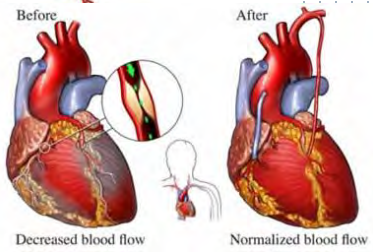
Motivation

Critical diseases in China (25 types)





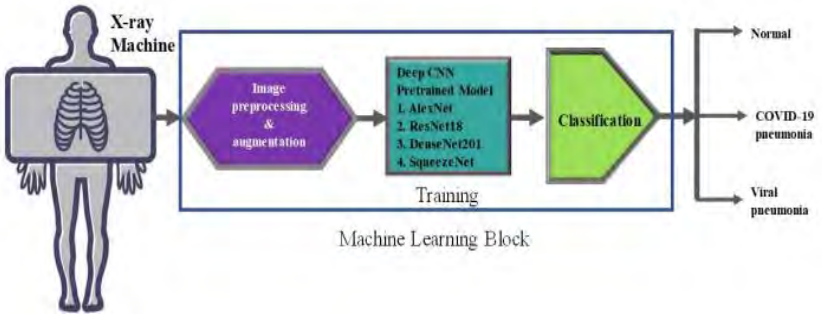




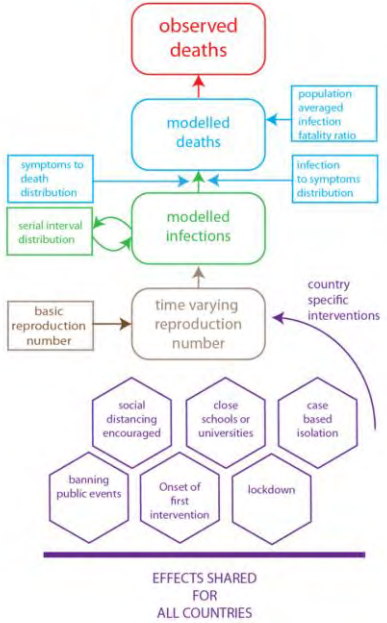
Malignant tumor, acute myocardial infarction, sequelae of cerebral apoplexy, major organ transplantation or hematopoietic stem cell transplantation, coronary artery bypass grafting (or coronary artery bypass grafting), end-stage renal disease (or uremia phase of chronic renal failure)

International open source models

COVID-19-Chest-X-ray-Detection: classify COVID-19, Viral pneumonia and Normal Chest X-ray images with an accuracy of 98.3%



Covid19model: modelling estimated deaths and cases for COVID19



International open source models

xDNN-SARS-CoV-2-CT-Scan: an eXplainable Deep Learning approach (xDNN)

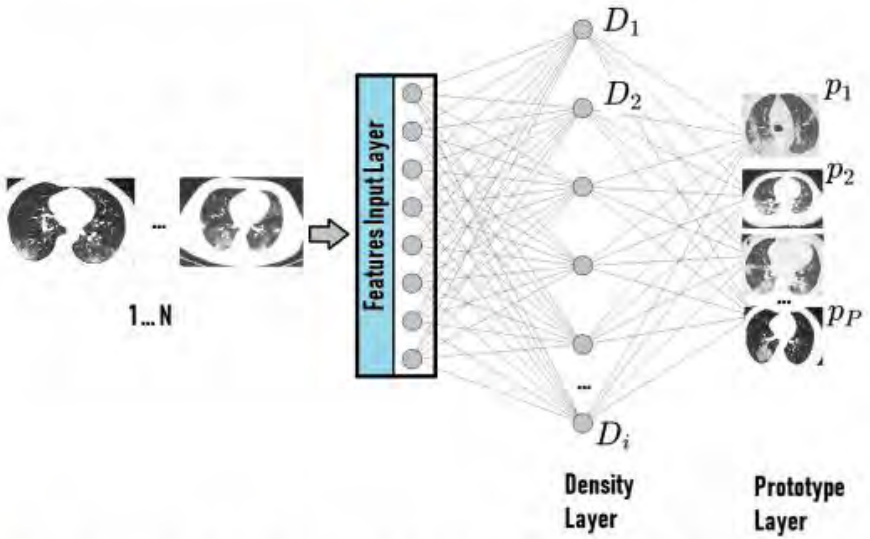


Figure 1. This figure illustrates the layered architecture of the proposed method. It has the form of a deep neural network but is using clear to understand prototypes (actual images). The density layer identifies the local peaks of the density and empirically derived probability distributions. The prototypes are actual training data samples (in this case, images) which are highly representative (local peaks of the density and empirically derived probability distributions.

International open source models

COVID-19-CT-Seg-Benchmark: Accurate segmentation of lung and infection in COVID-19 CT

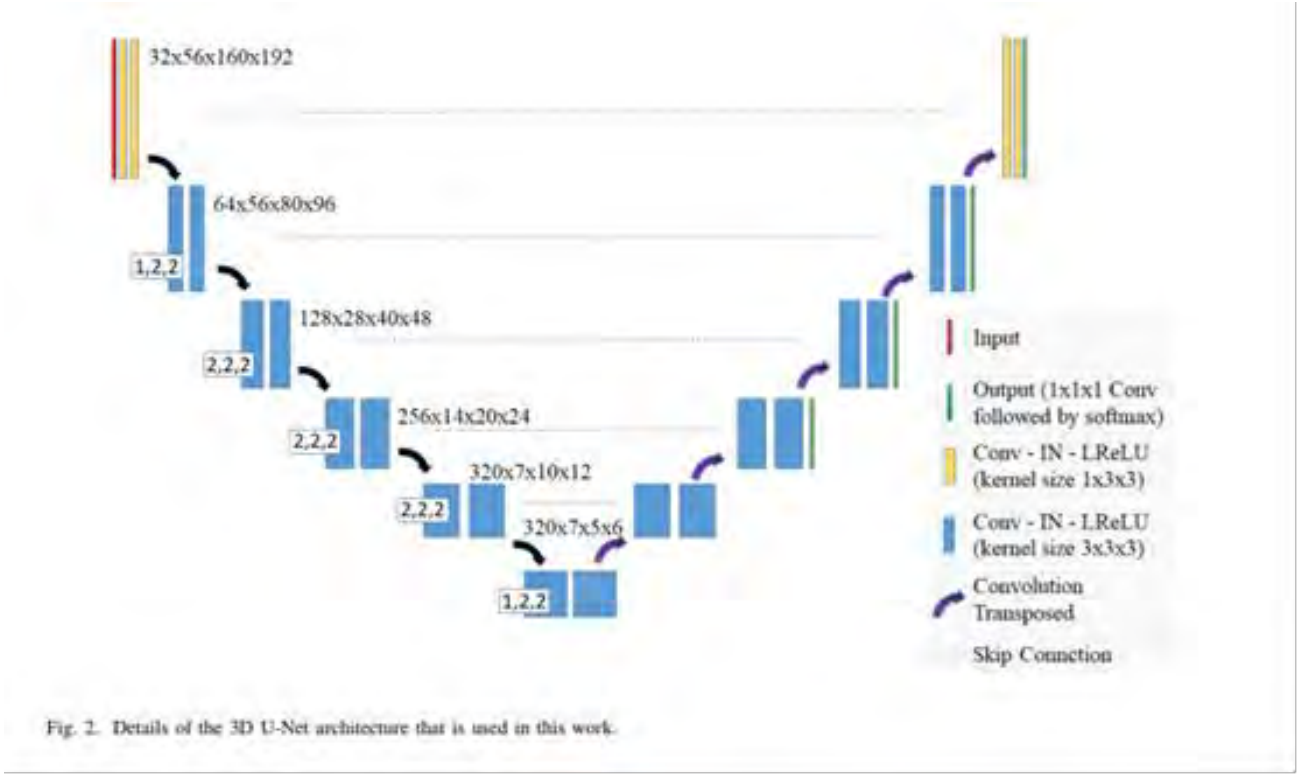


Fig. 2. Details of the 3D U-Net architecture that is used in this work.

International open source models

COVID-Net：a convolutional neural network for detecting COVID-19 through chest radiography

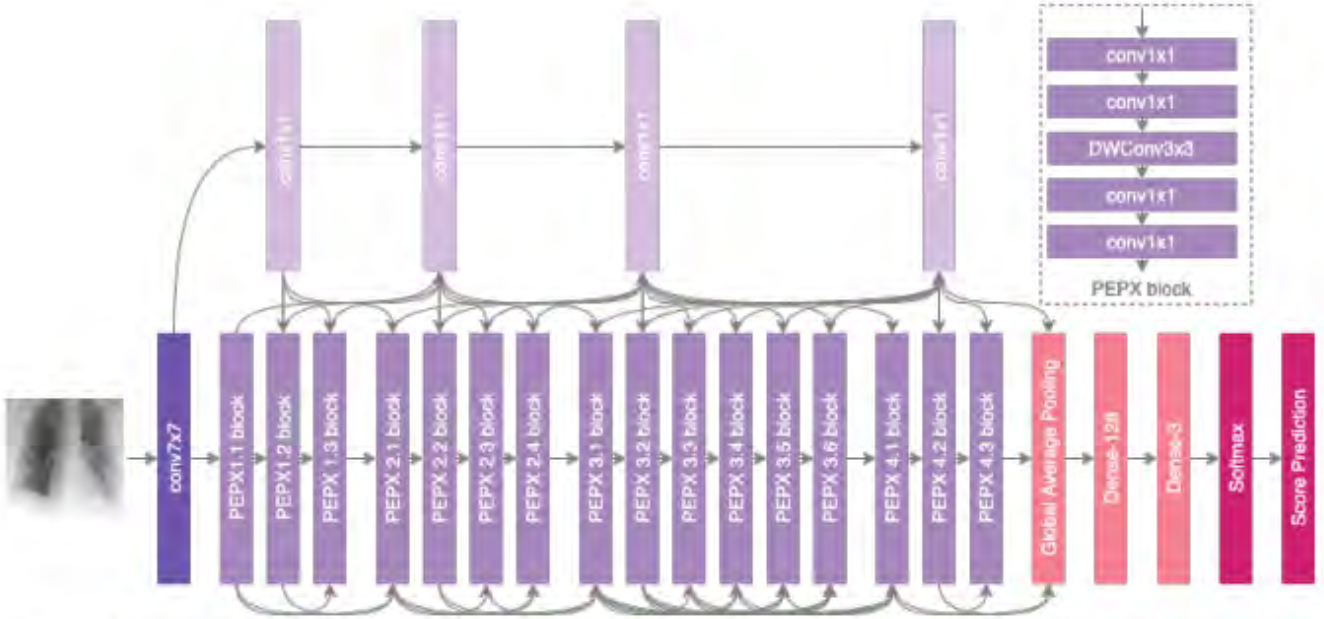
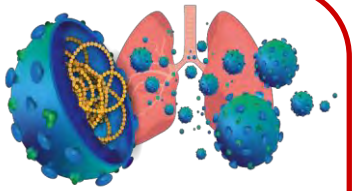


Figure 1. Flowchart of the overall architecture of the deep neural networks for predicting SARS-CoV-2 severity scores.

Health Encyclopedia Code (HEC)

Infectious diseases



Influenza Virus affects the respiratory system.

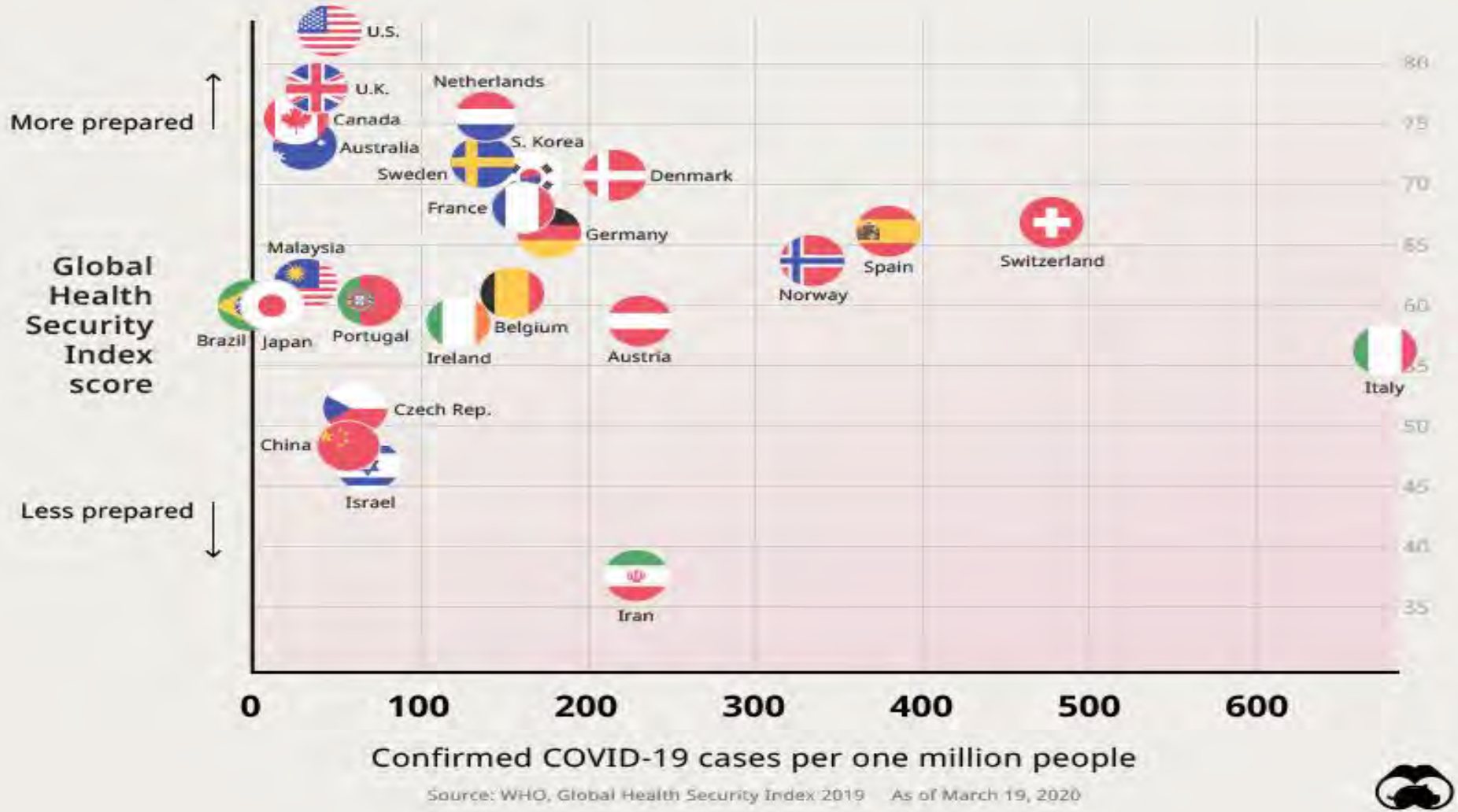
37 kinds of diseases:

Type I : plague and cholera

Type II: SARS, AIDS...

Type III: influenza, mumps..

Ranked: Global Pandemic Preparedness by Country


More prepared
Less prepared
Global Health Security Index score
U.S.
U.K.
Canada
Australia
Netherlands
S. Korea
Sweden
Denmark
France
Germany
Malaysia
Brazil
Japan
Portugal
Belgium
Ireland
Austria
Norway
Spain
Switzerland
Italy
Czech Rep.
China
Israel
Iran
80
75
70
65
60
55
50
45
40
35
0
100
200
300
400
500
600
Confirmed COVID-19 cases per one million people
Source: WHO, Global Health Security Index 2019 As of March 19, 2020

HEC in other countries

Country	PHR system	Description	Data content
US	Blue Button	patients view online and download their own personal health records.	
UK	PatientView App	Renal patients, Renal patient view, provides online information for kidney patients' including diagnoses, treatment and latest test results.	
Australia	PCEHR	Personally Controlled Electronic Health Records	

International open source models

covid-cxr: Neural network model for classifying chest X-rays by presence of COVID-19 features

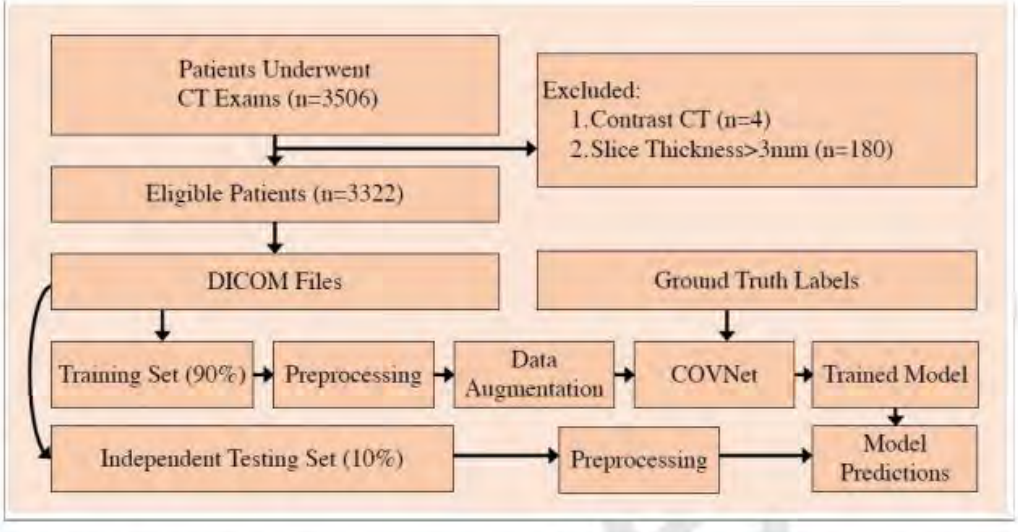


Fig 1. Flow diagram. We collected a dataset of 3506 patients with chest CT exams. After exclusion, 3,322 eligible patients were included for the model development and evaluation in this study. CT exams were extracted from DICOM files. The dataset was split into a training set (to training the model), and the independent testing set at the patient level. A supervised deep learning framework (COVNet) was developed to detect COVID-19 and community acquired pneumonia. The predictive performance of the model was evaluated by using an independent testing set. COVNet = COVID-19 detection neural network.

HEC in other countries

Government-led

National initiative:

- e.g., Australia, Italia

NGO-led

"Service-oriented":

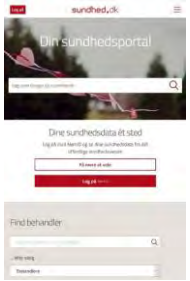
- e.g., US, UK

Enforcement

State financial support

- e.g., Denmark

HEC in other countries

Country	PHR system	Description	Data content
Denmark	sundhed.dk	Danish Healthcare Services enables citizens and healthcare professionals	
Italia	Lombardy CRS-SISS system	Lifelong PHR embedded in the regional healthcare information system of Lombardy	

Content of HEC

String 1 : Personal Information

String 2 : Omics

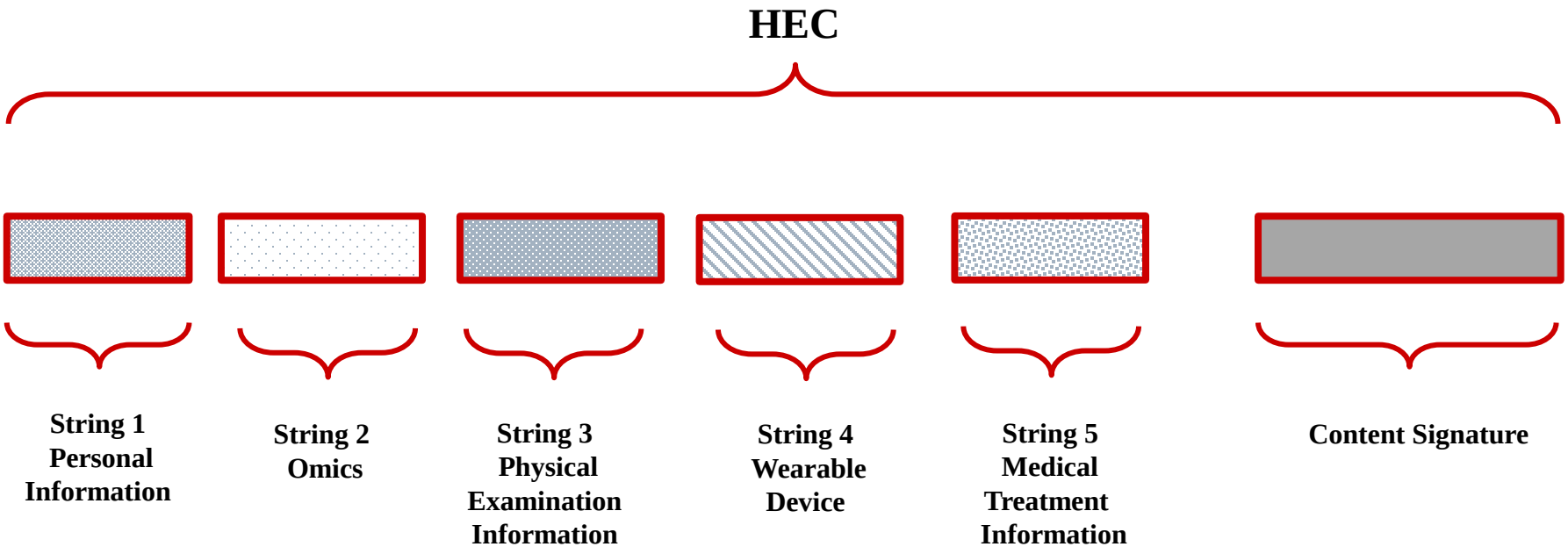
String 3 : Physical Examination Information

String 4 : Wearable Device

String 5: Medical Treatment Information

- Infectious diseases:
  - string 1+2+3+5;
- Basic chronic diseases:
  - string 1+2+4;
- Critical disease:
  - string 1+2+5

Content of HEC

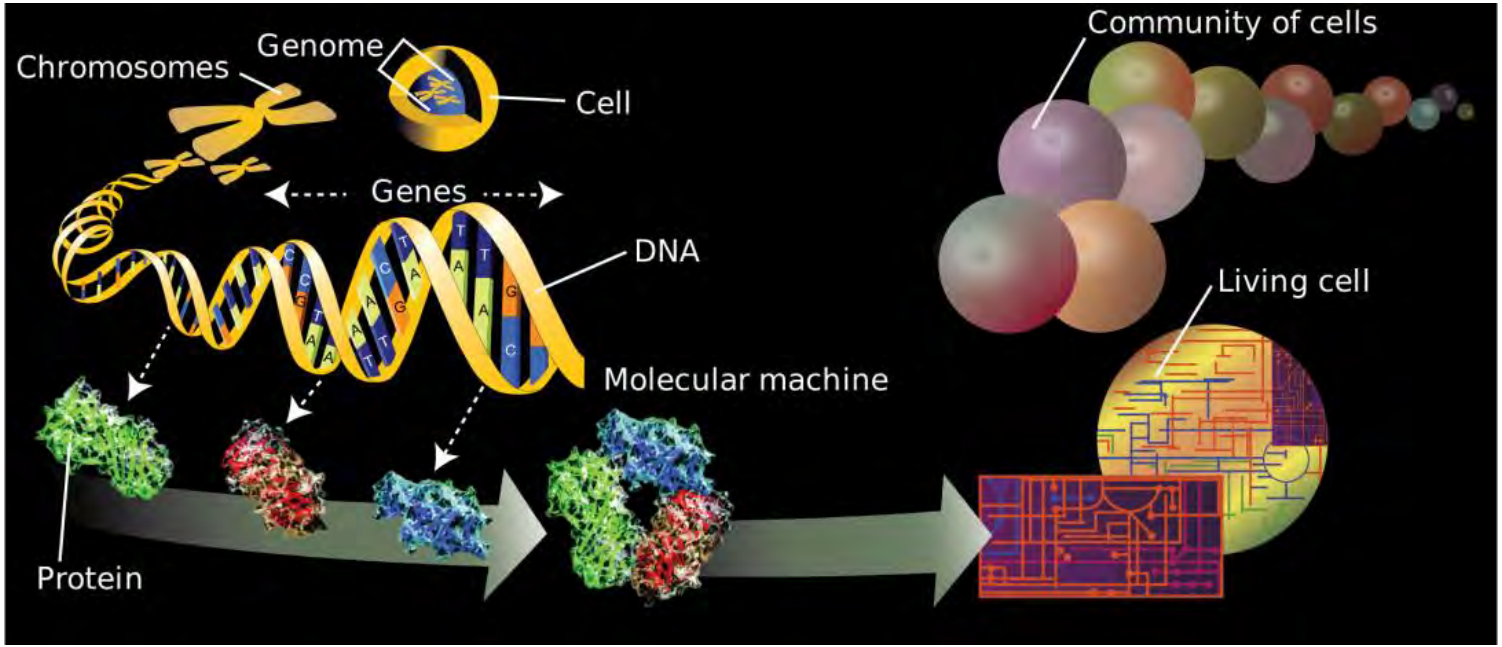


String 1 : Personal information

- **Personal information**: name, gender, nationality, ID, personal biometric information, etc.

- **Personal track**: Public security, mobile operation network, health commission, traffic (high-speed railway, airport, expressway crossings)

String 2 : Omics

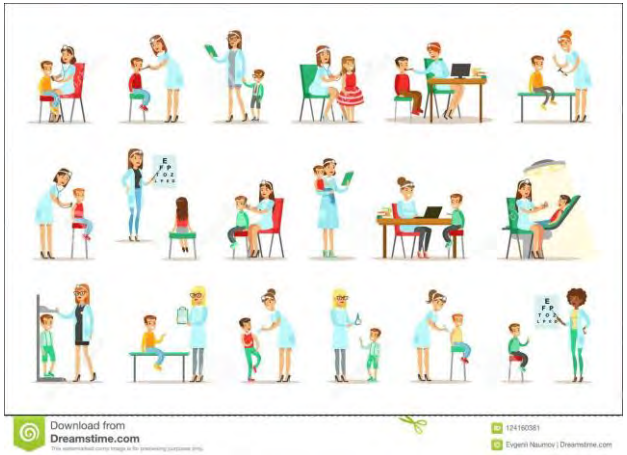


Omics: analysis of complete genetic or molecular profiles.

Genetics: single genes

Gen**omics**: all genes (genomes) and their relationship.

String 3 : physical examination



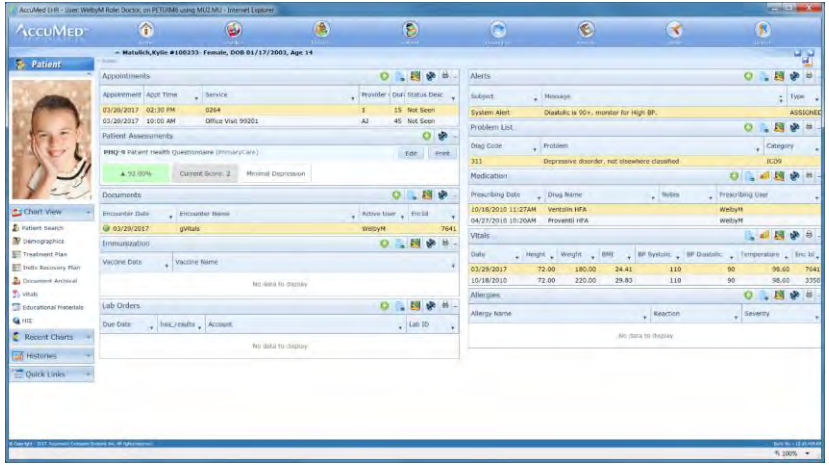
height, weight, blood pressure, blood sugar, blood routine, urine routine, diet, sleep

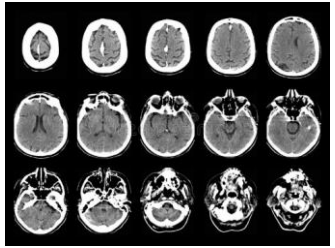
String 4 : Wearable device

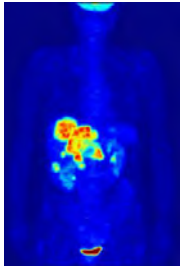
Sports and fitness outdoor areas: heart rate, cadence, air pressure, diving depth, altitude, sleep, monitoring running, jogging, walking, cycling, skiing, weightlifting repeatability count

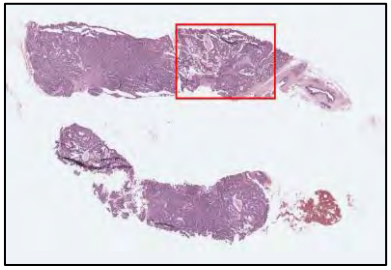
Healthcare: blood pressure, heart rate, blood oxygen, pulse

String 5 : medical treatment information









Text:

History of basic medical, history of family, history of allergies, history of immunizations, medical records, medication use, surgical and radiotherapy procedures, laboratory results, diagnostic reports

Images and videos:

X-ray, CT, Ultrasound, MRI, PET, pathology

Content of HEC

- Data storage:
  - Hospitals: basic data (text + image)
  - Cloud brain of PCL: features (NLP + image + video)
- Computation:： Cloud brain of PCL

Security

- Against attack：
  - Photo copy
    - GAN：Generate the same HEC of others
  - Encryption：
    - Fragile watermark

Security

- Physical attack：
  - system Intrusion
    - Data tampering

	Project name	content	Organization
COVID-19 cases and deaths	COVID-19	COVID-19 cases and deaths in the world	Johns Hopkins University
	covid-19-data	COVID-19 cases and deaths in the US	The New York Times
	covid19india-react	COVID-19 cases and deaths in India	Individual
	COVID-19	COVID-19 cases and deaths in Italia	Individual
	covid-19-data	COVID-19 confirmed cases, deaths, and tests in the world	Our World in Data
Radiological images	covid-chestxray-dataset	COVID-19 cases with chest X-ray or CT images	University of Montreal
	COVID-CT	349 CT images containing clinical findings of COVID-19 from 216 patients	University of California at San Diego
	covid19	COVID-19 CT segmentation dataset	Unknow

	Project name	content	Organization
Radiological images	COVID-CT	349 CT images containing clinical findings of COVID-19 from 216 patients	University of California at San Diego
	covid19	COVID-19 CT segmentation dataset	Unknow
	COVID-19-CT-Seg-Benchmark	COVID-19 CT scans from non-COVID-19 CT scans	Unknow
	covid-19-image-repository	Radiological images about COVID-19	Unknow
	COVID-19 chest xray	A database of COVID-19 cases with chest X-ray or CT images.	Kaggle
	SARS-COV-2 Ct-Scan Dataset	A SARS-CoV-2 CT scan dataset, containing 1252 CT scans that are positive for SARS-CoV-2 infection (COVID-19) and 1230 CT scans for patients non-infected by SARS-CoV-2	Kaggle
Natural language	covid-qa	A collection of COVID-19 question-answer pairs and transformer baselines for evaluating QA models	Unknow

covid19_scenarios: Models of COVID-19 outbreak trajectories and hospital demand