

## *Lecture on "Forecasting epidemics based on big data"*

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At 7pm to 8:30pm on March 18, 2021, the lecture of “can ‘AI+Big Data’ predict the occurrence of infectious diseases a week in advance” of School of Silicon Valley Artisan of USJ broadcasted live online globally.

Nowadays, as many countries have started and gradually promoted COVID-19 vaccination, the number of new confirmed cases and deaths of COVID-19 globally has been declining, and the epidemic situation is improving; California and other areas hardest hit by the epidemic have tried again to gradually open outdoor dining and reopen schools to wait for measures to try to get people's lives back on track.

According to data from Johns Hopkins University in the United States, since February this year, the number of new cases of COVID-19 globally has shown an overall downward trend. However, some experts pointed out that it is too early to discuss the end of the epidemic, and the real "turning point" of the epidemic has not yet arrived.

Stanley Perlman, a professor of microbiology and immunology at the University of Iowa in the United States, said that vaccination continues to be carried out globally, but only when people all over the world are vaccinated to establish a sense of security and comfort can the spread of the virus be controlled, the global epidemic has really reached the "turning point." Otherwise, the COVID-19 will remain latent and there is a risk of constant mutation.

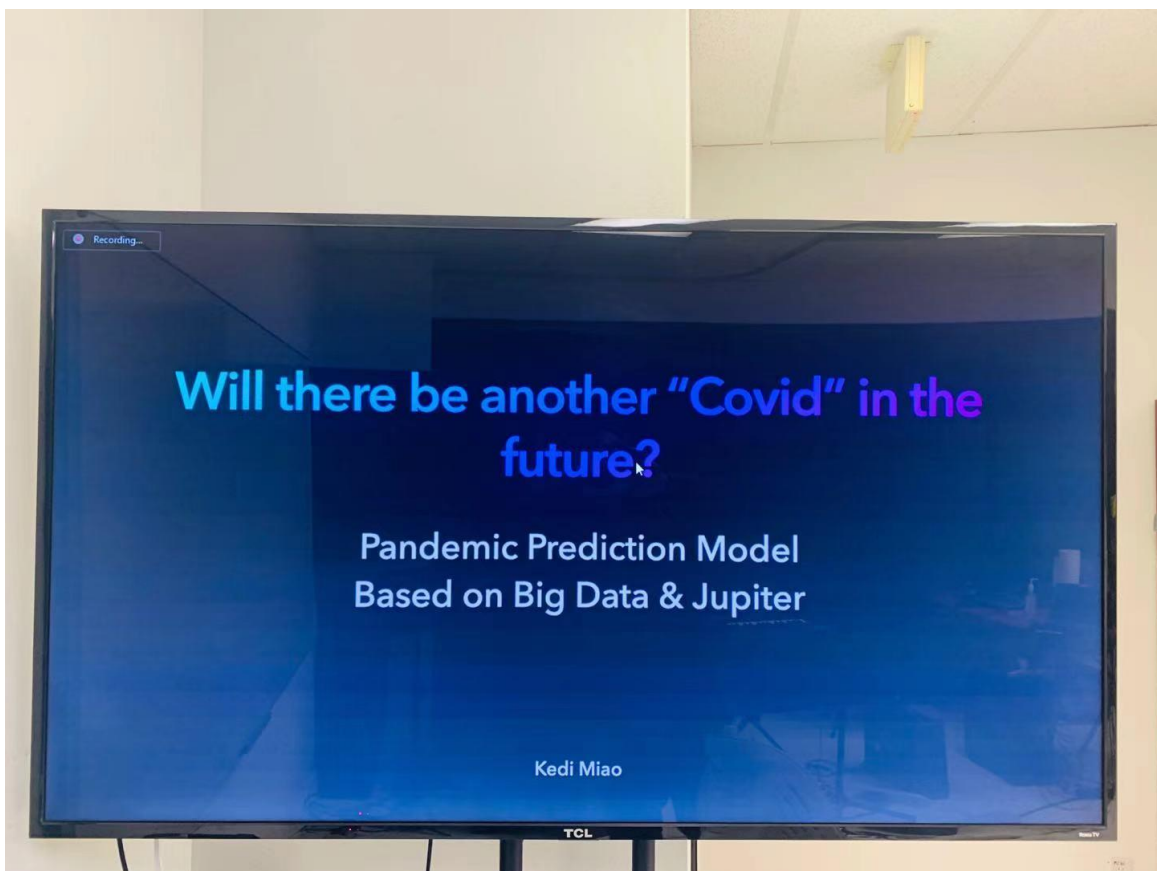
It can be seen that it will take a long time for mankind to truly conquer the COVID-19. Then we will not only reflect on how much loss can mankind reduce if the COVID-19 can be successfully predicted at the beginning of the epidemic? At the same time, will there be a second COVID-19 in the future? It can be seen that only when every major pandemic outbreak in the future can be predicted in time, can we truly defeat the pandemic.

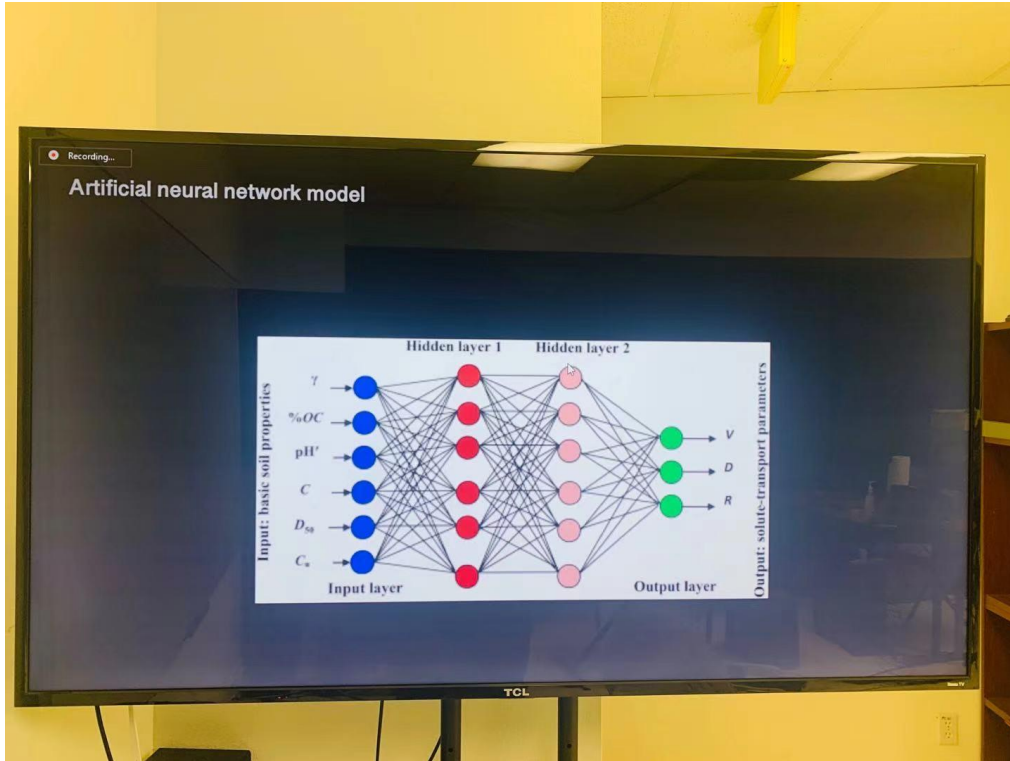
Therefore, it is particularly important to use big data to predict the development trend of epidemics. For the outbreak of infectious diseases, the models currently used in forecasting and

early warning at home and abroad mainly include time series models, linear regression models, gray system theory, artificial neural network models, Markov model, Yebes model, etc.

The following are the main points summarized by the USJ instructor Kedi.

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### Walmart API

Rich Media API

Rich media includes material such as videos, comparison tables, and user-ISO media which is item-specific. Extract the IDs for the Rich Media API below.

Rich media can be updated only as an update for an item which has already been registered. Item Rich updates which contain rich media will cause that item ingestion to fail. To update rich media, you must wait for the item ingestion process to complete successfully, then make a POST call with the Rich media content for the updated items.

Request URL

<https://www.walmart.com/api/v2/items/{itemId}/rich-media>

Name	Description	Required	Example
WM_SVCNAME	Walmart Service Name	Yes	Walmart Gateway API
WM_DOCCORRELATIONID	A unique ID which identifies each API call and used to track and identify issues on a random generated GUID for this ID	Yes	12345678
WM_SECURESSAMP	The Epoch timestamp	Yes	1457890123456
WM_SECAUTHSIGNATURE	The vendor's digital signature, generated by hashing the JAR	Yes	PhjTTPuWwSQMNCZGpVORhRmBjQvnyWpZCPvWmRkUqRwKQDZhaP

Sample Request

```
POST /api/v2/items/{itemId}/rich-media HTTP/1.1
Host: www.walmart.com
Content-Type: application/json
Authorization: Basic dXNlcm5kaW86dXNlcm5kaW86
{
  "items": [
    {
      "itemId": "12345678",
      "richMedia": [
        {
          "type": "VIDEO",
          "url": "https://www.walmart.com/api/v2/items/{itemId}/rich-media",
          "description": "Rich Media Description"
        }
      ]
    }
  ]
}
```

## I. The review of lecture of “can ‘AI+Big Data’ predict the occurrence of infectious diseases a week in advance?”

### 1. Time series model (ARIMA model)

As a classic model in univariate time series analysis, it is one of the more mature and widely used methods in time series analysis. The analysis process is simple, and the short-term prediction accuracy is high. The disadvantage is that if the data is more complex, it is not easy to select the parameters of the model, and if the data has a specific event at some time, the model cannot consider the data at this specific time, and the model parameters need to be corrected, and the prediction accuracy for small samples is poor, the early warning of small-scale outbreaks is more difficult. For long-term historical data, its prediction accuracy is also worse than other models.

### 2. Linear regression model

Commonly used regression models include linear regression model, quadratic curve model, cubic curve model, exponential curve model and so on. The regression model takes into account various influencing factors that affect the occurrence of diseases, and can analyze complex data.

### 3. Grey system theory

The advantages of this model in disease prediction are:

- (1) Few data, as few as 4 data can be used to establish a model for prediction, and the use of data contaminated by noise can be allowed.
- (2) Good timeliness
- (3) Strong system and correlation
- (4) The modeling accuracy is high, and the characteristics of the original system can be maintained. It can be used for long-term trend forecast analysis, as well as medium and short-term forecasting.

### 4. Markov model

Markov model is a non-parametric discrete time series analysis method. Markov model is particularly suitable for disease data with volatility changes. Markov model is an effective tool to explore the influencing factors of different stages of chronic disease.

#### 5. Artificial Neural Network Model

The biggest advantage of artificial neural network is that it can adjust its structure to adapt to the characteristics of the sample. It completely overcomes the inherent shortcomings of traditional parameter models that allow samples to adapt to themselves.

#### 6. Complex network model

The most classic infectious disease prediction and early warning models in the complex network theory model are SIR, SIS and SIRS models. The SIR model is used to predict the diseases in which individuals can obtain permanent immunity after infection. The SIS model is used for diseases in which individuals have no immunity after being cured. The SIRS model is used to obtain a certain period of immunity after an individual is infected with a disease.

## II. Lecture Content

1. Epidemic hazards and history
2. What is big data and cloud computing?
3. Existing mathematical models in epidemic prediction
4. How to scientifically use big data to predict epidemics?

## III . Lecturer

School of Silicon Valley Artisan of USJ Instructor: Kedi Miao



(Washington University in St. Louis EE Master; familiar with JAVA, JavaScript, React, Spring and Android development; experience in developing Android App independently)

#### IV. Organizer

USJ SVA



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