The Cell Differentiation Model of Bone Healing for Dental Implants

Presentor : Shih Kuang Lee (李世光, 0411504)

Yu Cheng Chen (陳宥誠, 0411544)

Chia Wei Hsu (許家維, 0411509)

Department : Material Science & Engineering, Senior Student
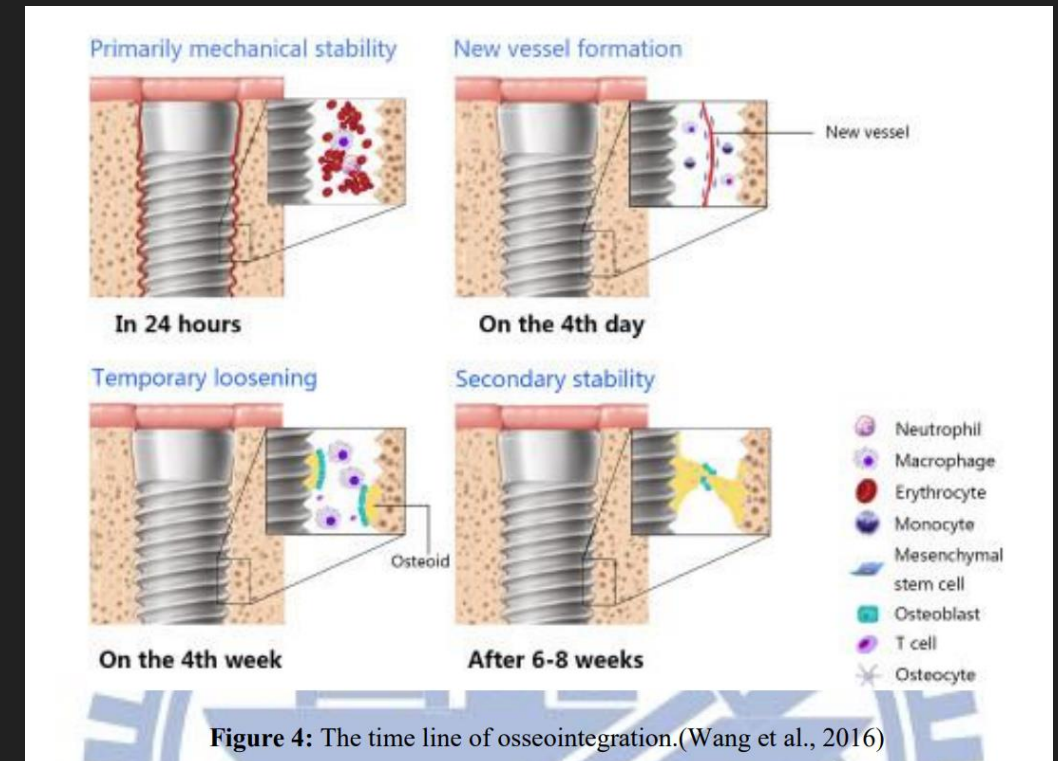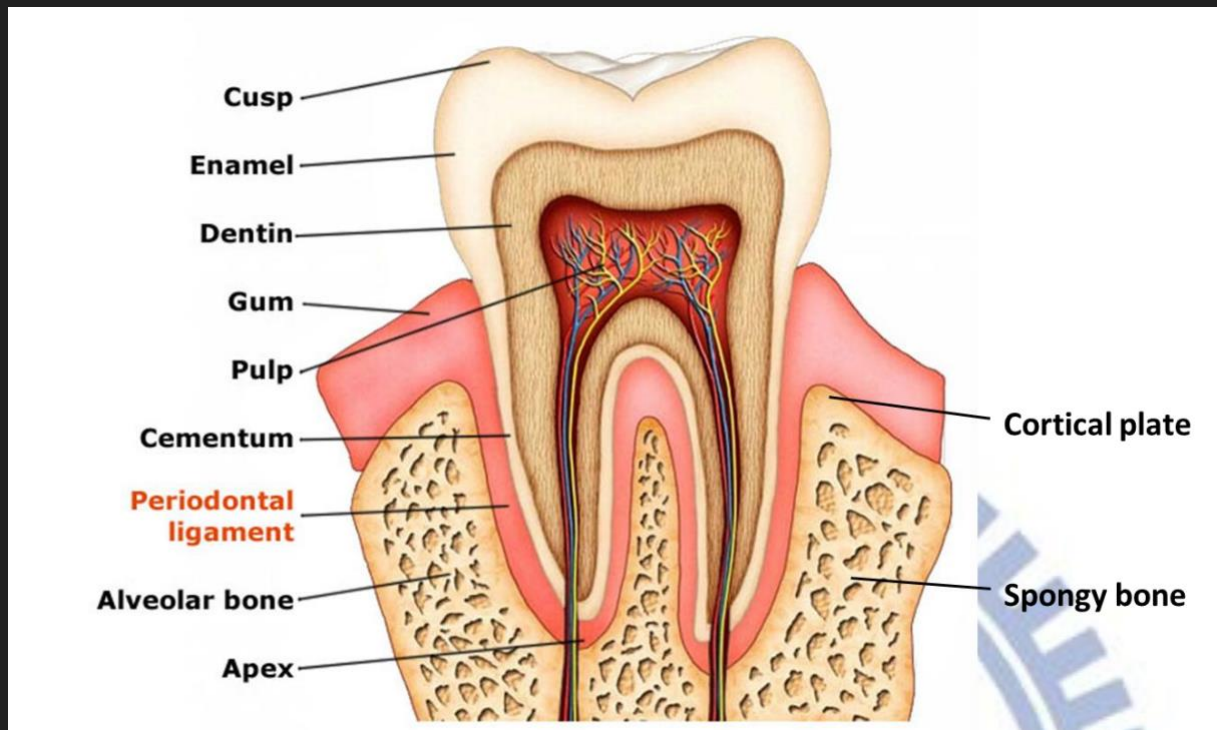
Outline

1. Data description

2. Pre-processing

3. Model & Result

Data Description

Presenter : Shih Kuang Lee (李世光, 0411504)

Data Description

Dental Implant

Figure 4: The time line of osseointegration.(Wang et al., 2016)
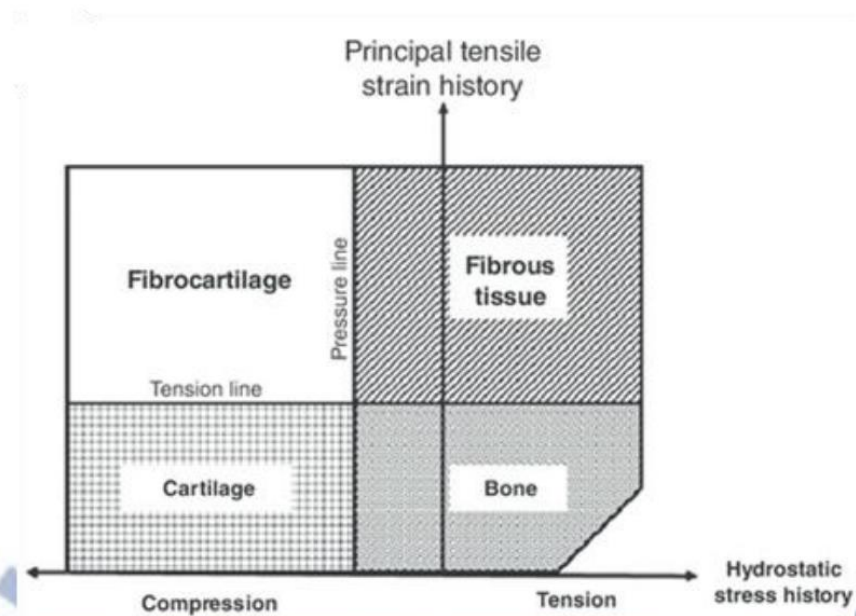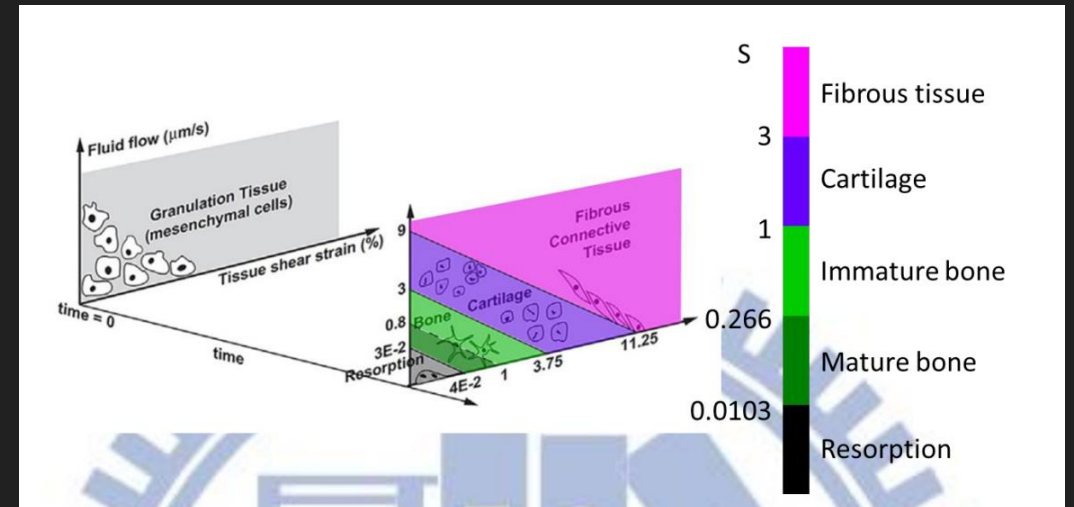
Data Description

Simulation Model

Figure 5: Mechano-regulation concept of cell differentiation supposed by Carter et al. (1998) where the biophysical stimuli are principal tensile strain and hydrostatic stress.

Data Description
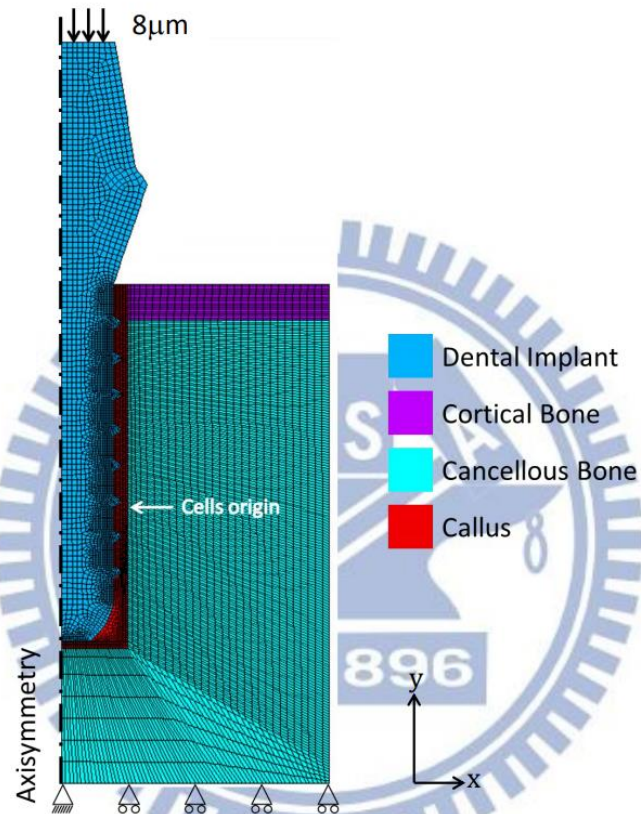
Simulation Model, with Ansys

Figure 15: The meshed geometry with the setting of the boundary conditions.
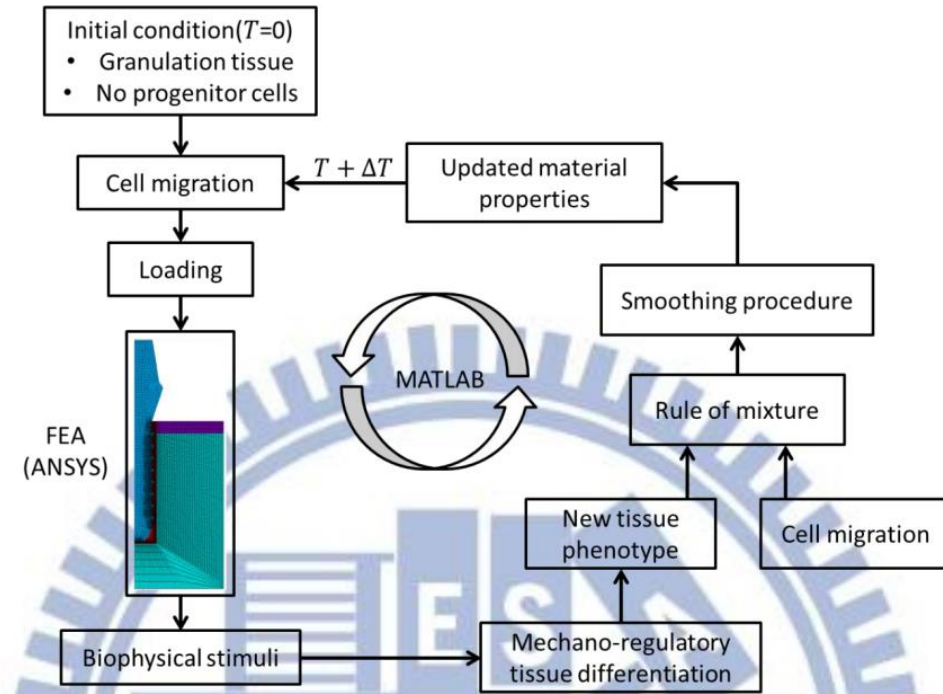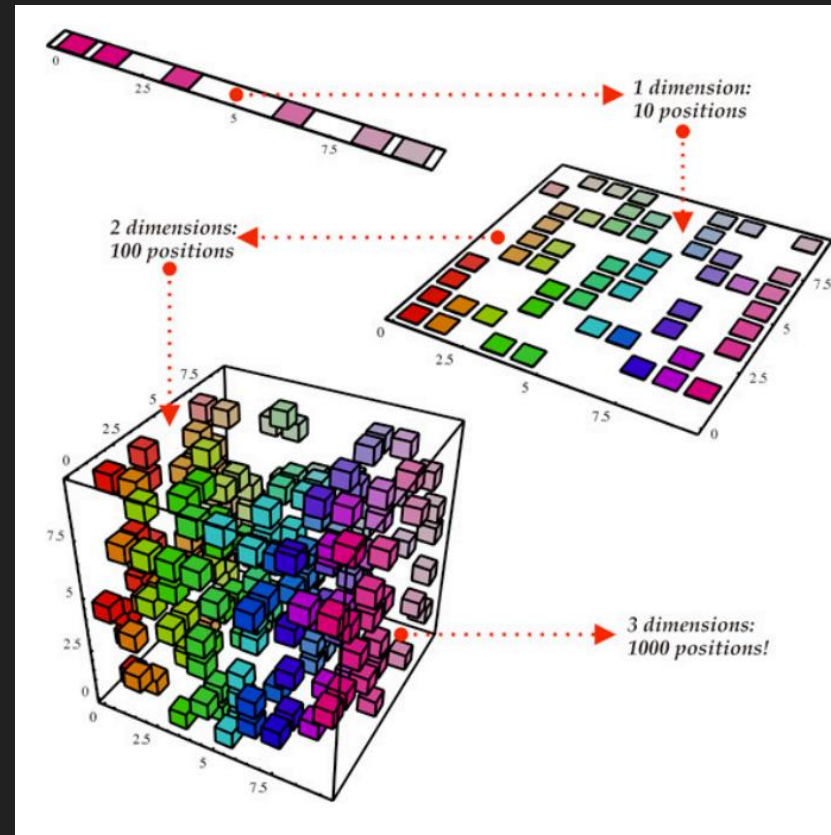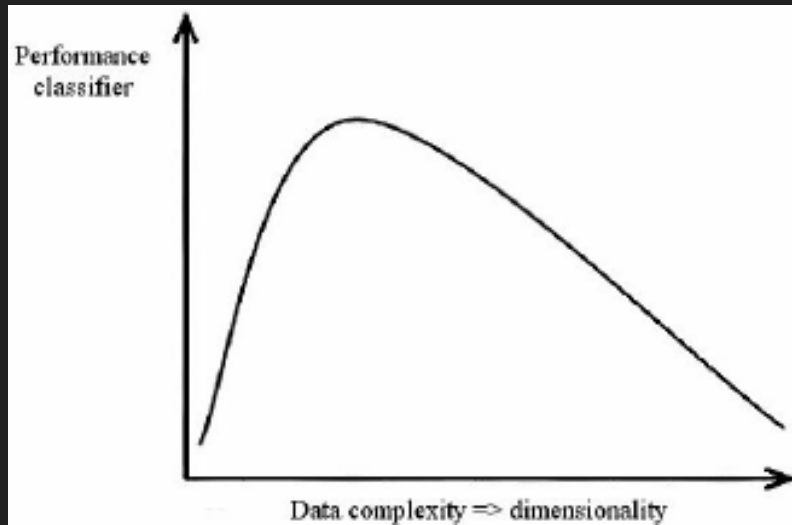

Figure 10: The simulation flow chart in our study which is controlled by MATLAB.
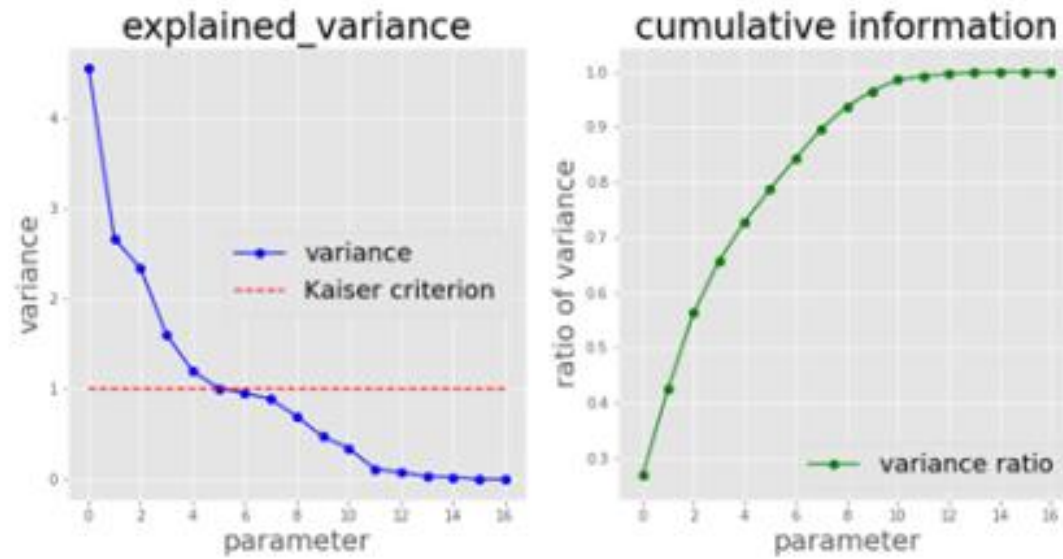
Pre-processing

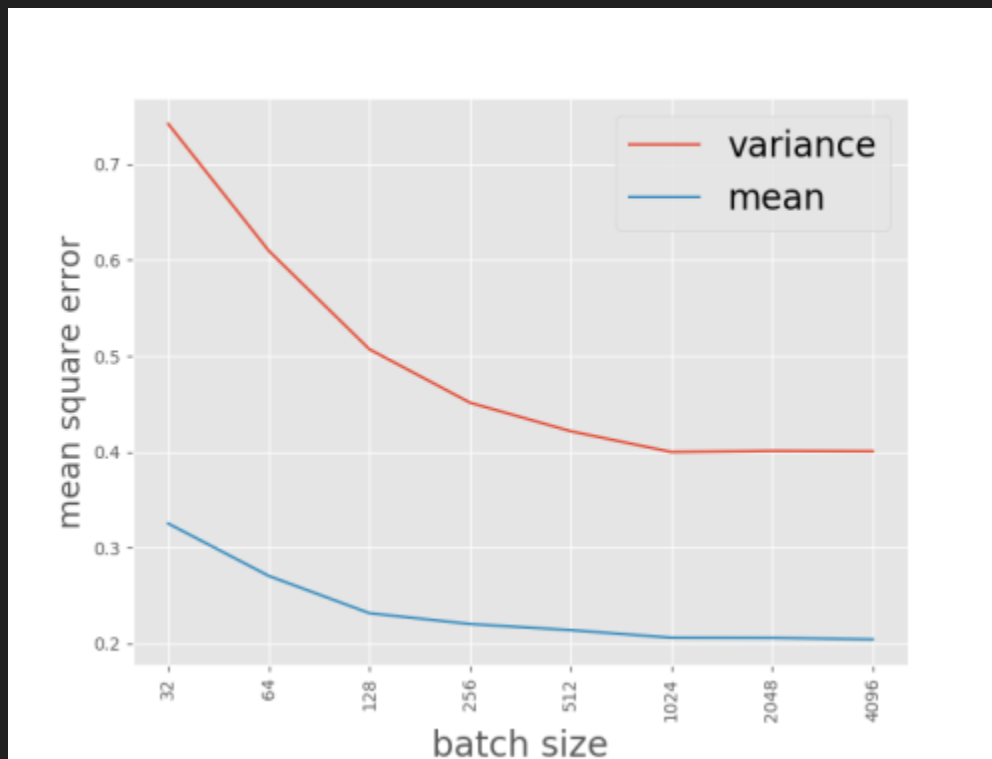Presentor: Yu Cheng Chen (陳宥誠, 0411544)

Data Description
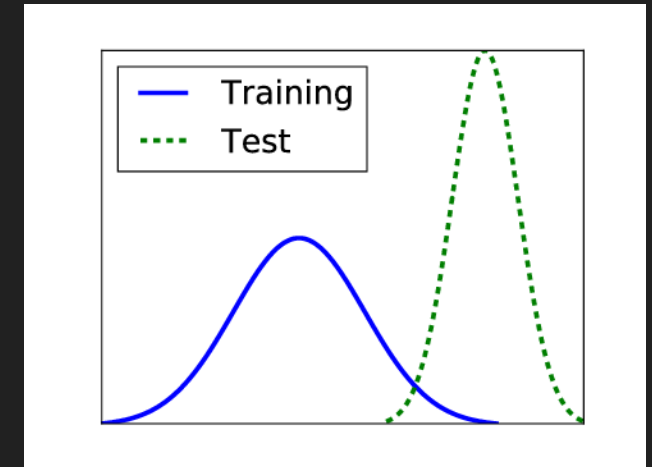
PCA

Batch Normalization – Why?

Batch Normalization
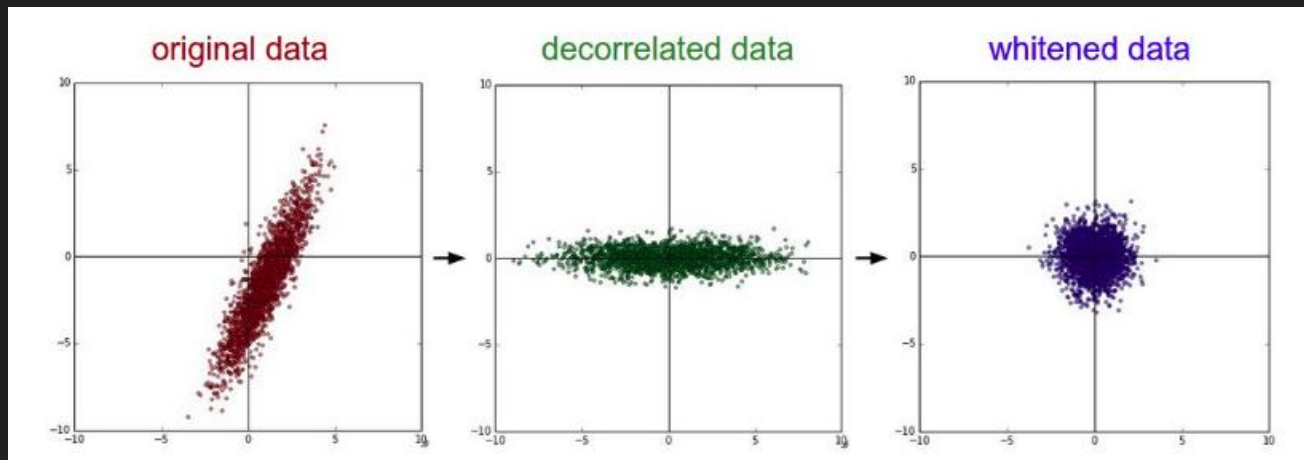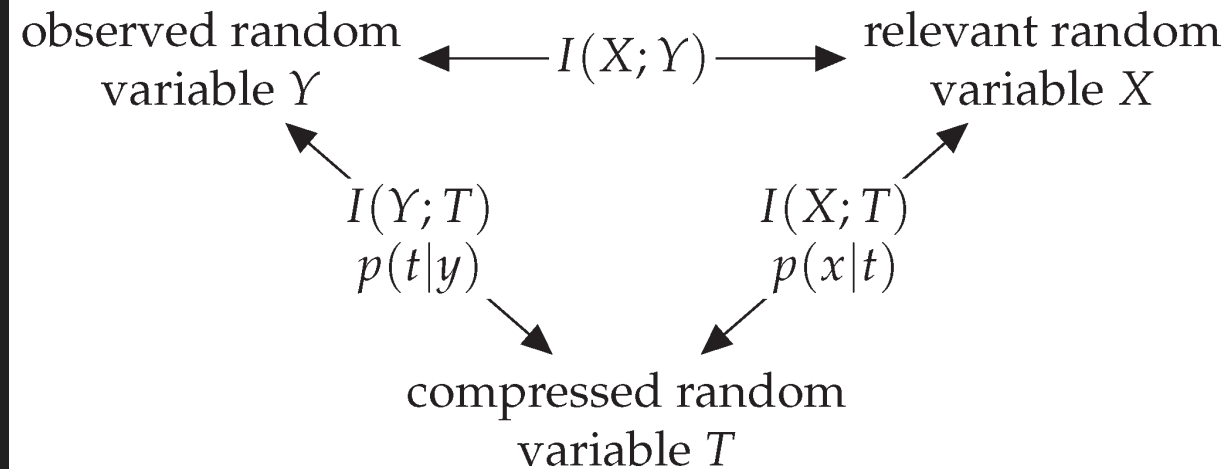
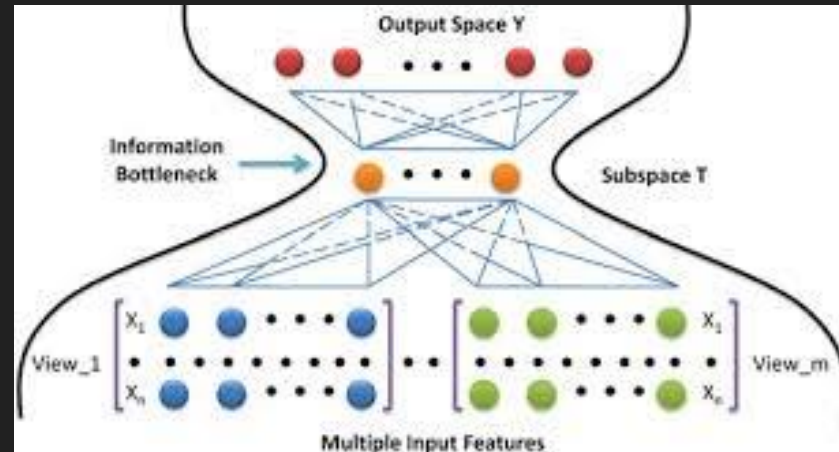Covariate shift
$P_S(x) \neq P_T(x)$
$P_S(y|x) = P_T(y|x)$
Source domain and Target domain input (output) space is same

Whitening

original data   decorrelated data   whitened data

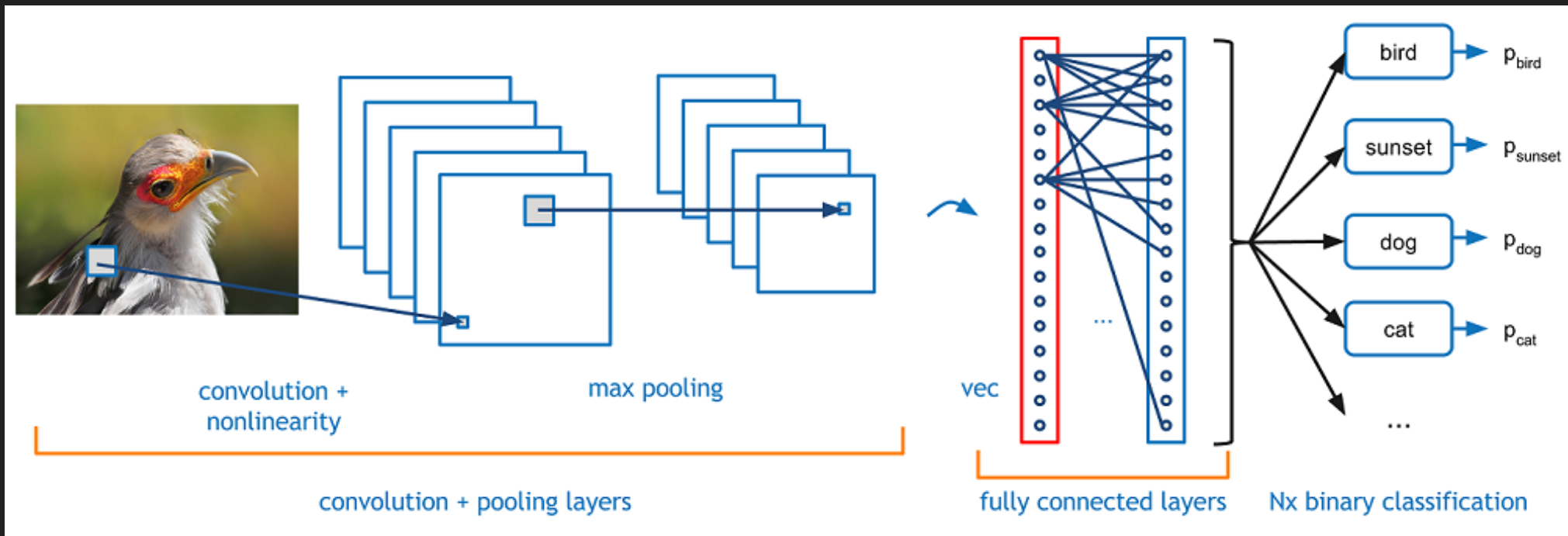Training
Test

Information Bottleneck

Model & Result
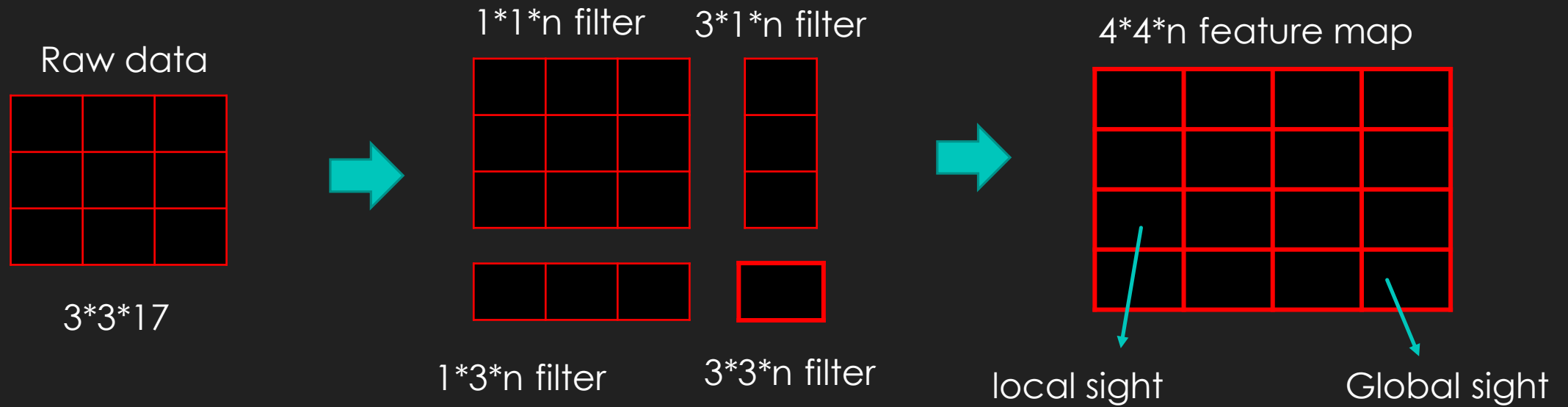
Presenter : Chia Wei Hsu (許家維, 0411509)

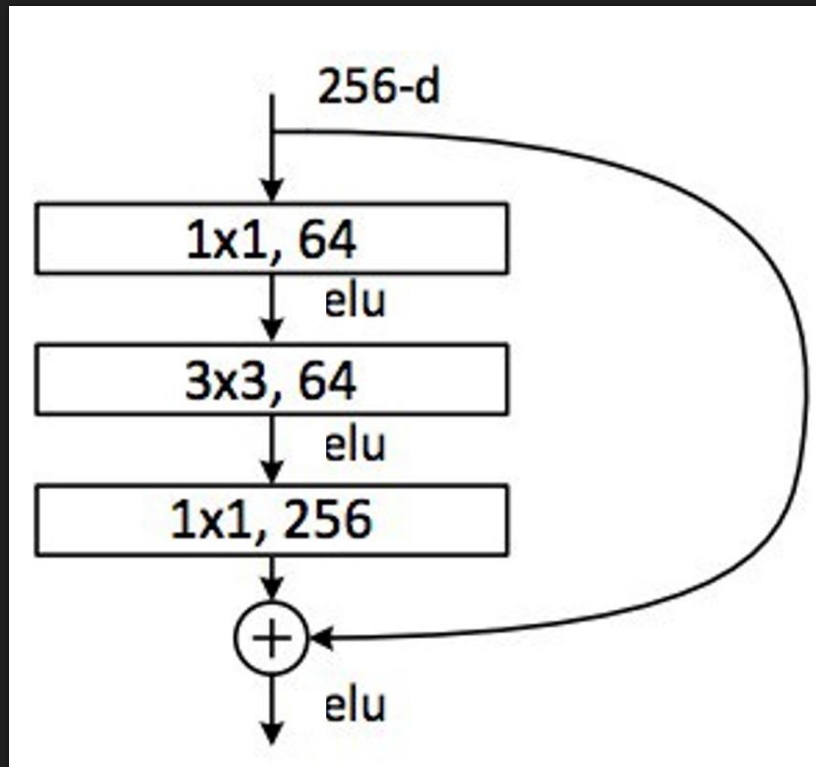# Model – Basic Idea

Convolutional Neural Network (CNN)

Model -1 inception

Raw data

3*3*17

1*1*n filter   3*1*n filter

1*3*n filter   3*3*n filter

4*4*n feature map

local sight   Global sight
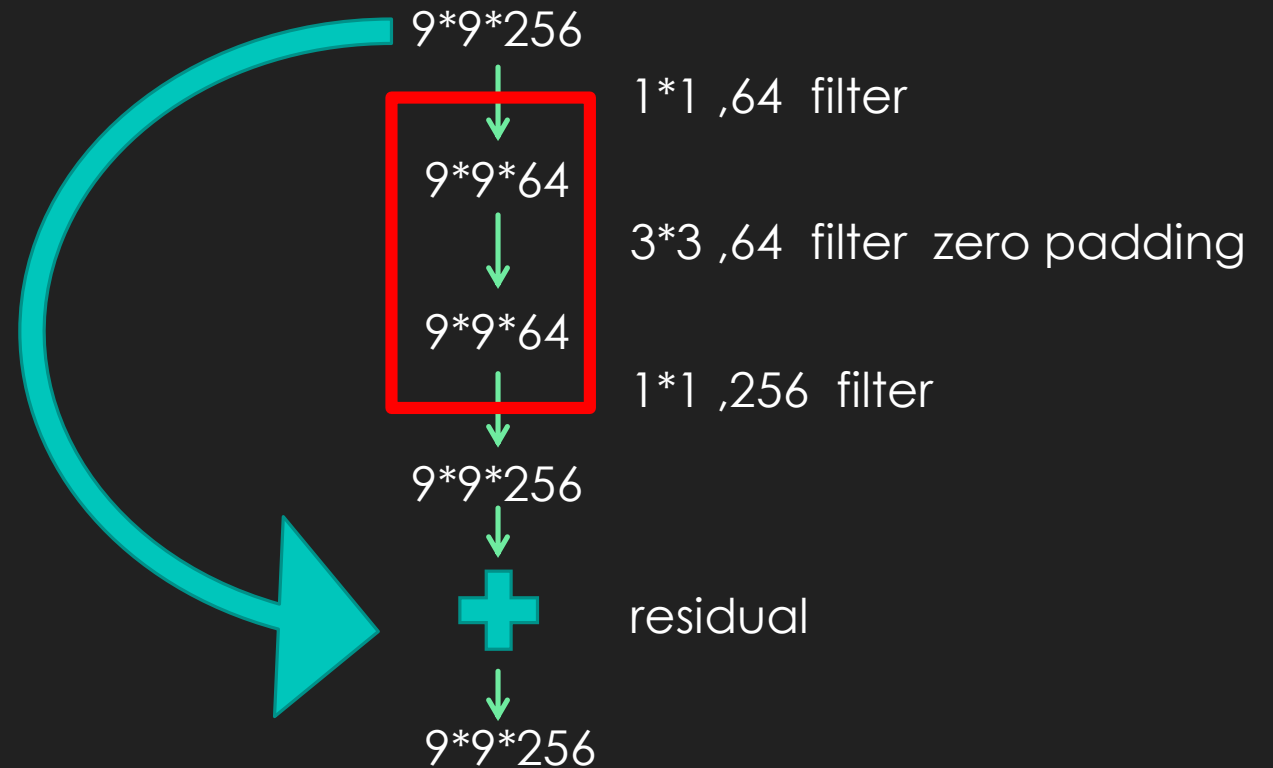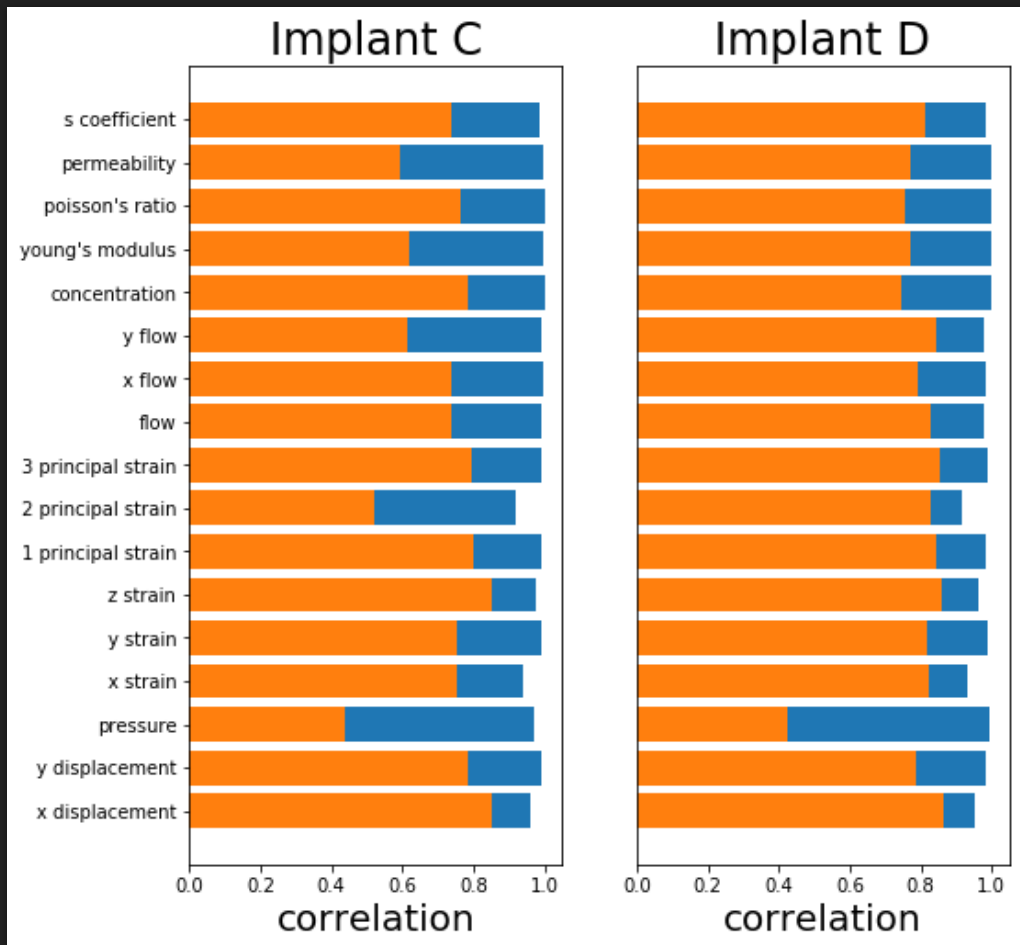
Final data will come to 9*9*256

Model -2 bottleneck

filter

Work flow

Result - correlation

Correlation list of 2 implant

Blue is direct compare
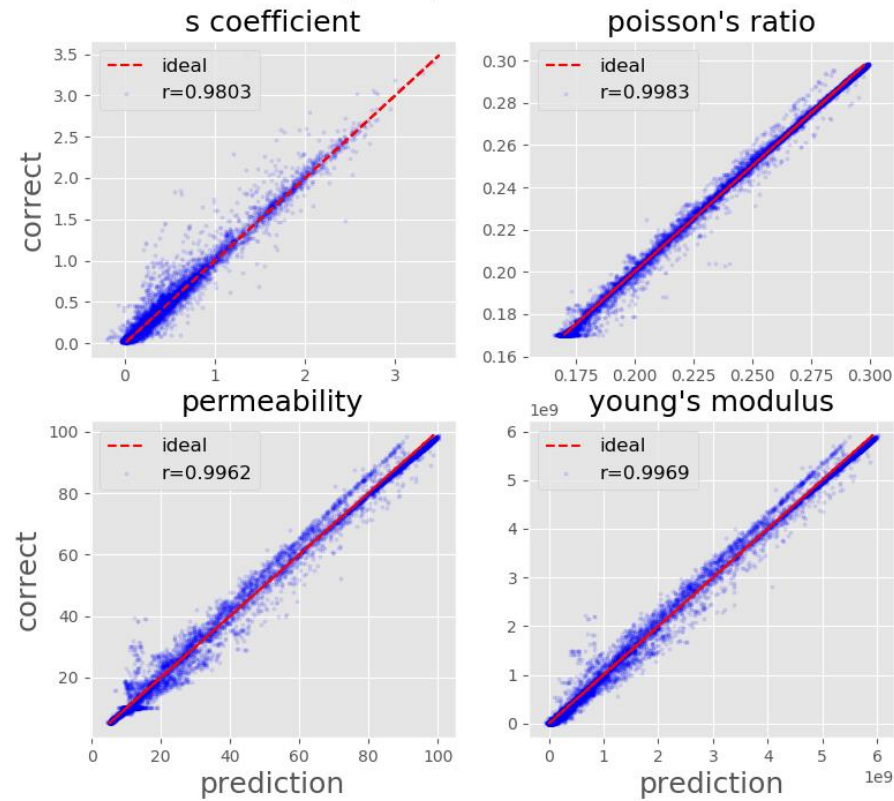R=0.98~0.99
Orange is residual by day
average R=0.7

Direct(X)
New day

Residual by day(ΔX)
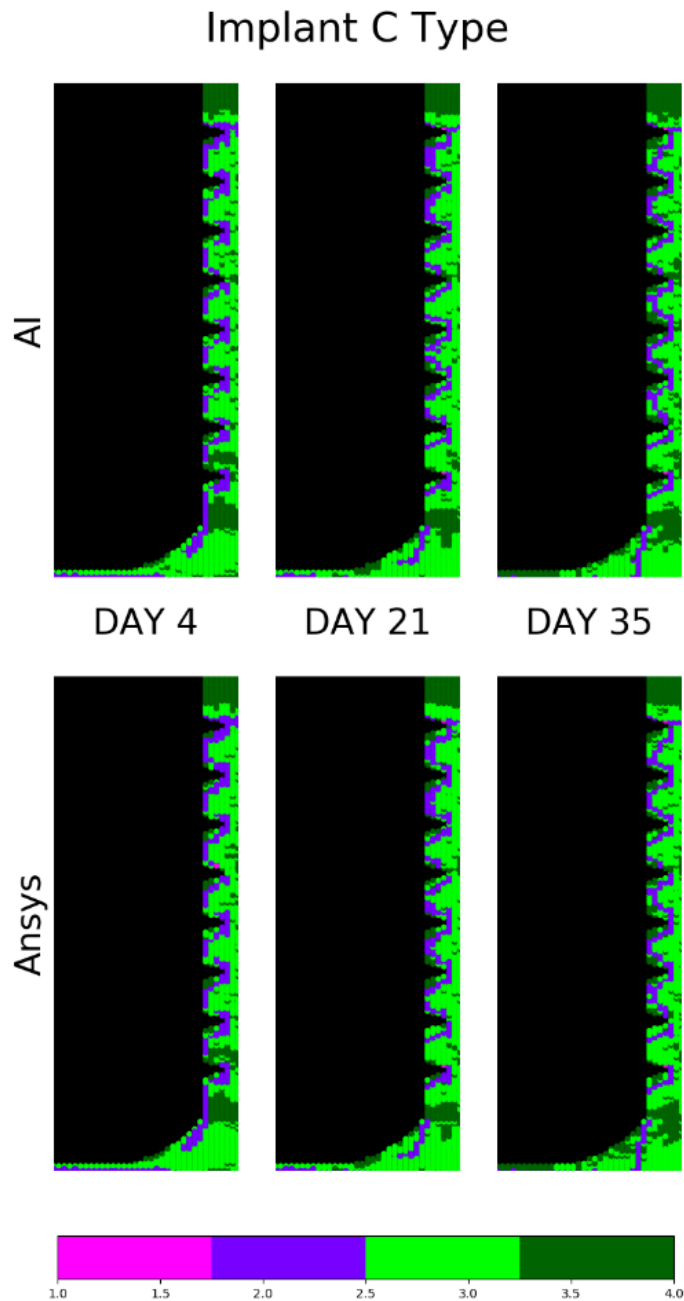New day – old day

Result - scatterplot

Result - visualize

Implant C Type

AI

DAY 4   DAY 21   DAY 35

Ansys

Mature bone — **Cartilage** — **Implant**
Immature bone — **Fibrous tissue** — **Resorption**

Reference

1. https://ir.nctu.edu.tw/handle/11536/141923

2. https://arxiv.org/abs/1512.00567

3. https://arxiv.org/abs/1512.03385