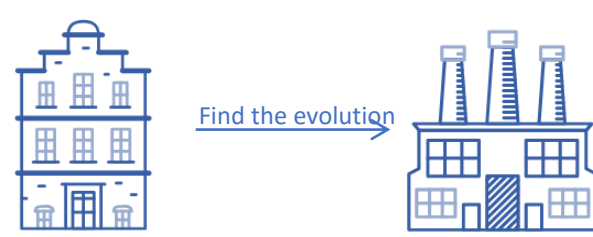


## / Introduction

The goal of our project is to analyze the evolution of world architectural styles.



## / Objective

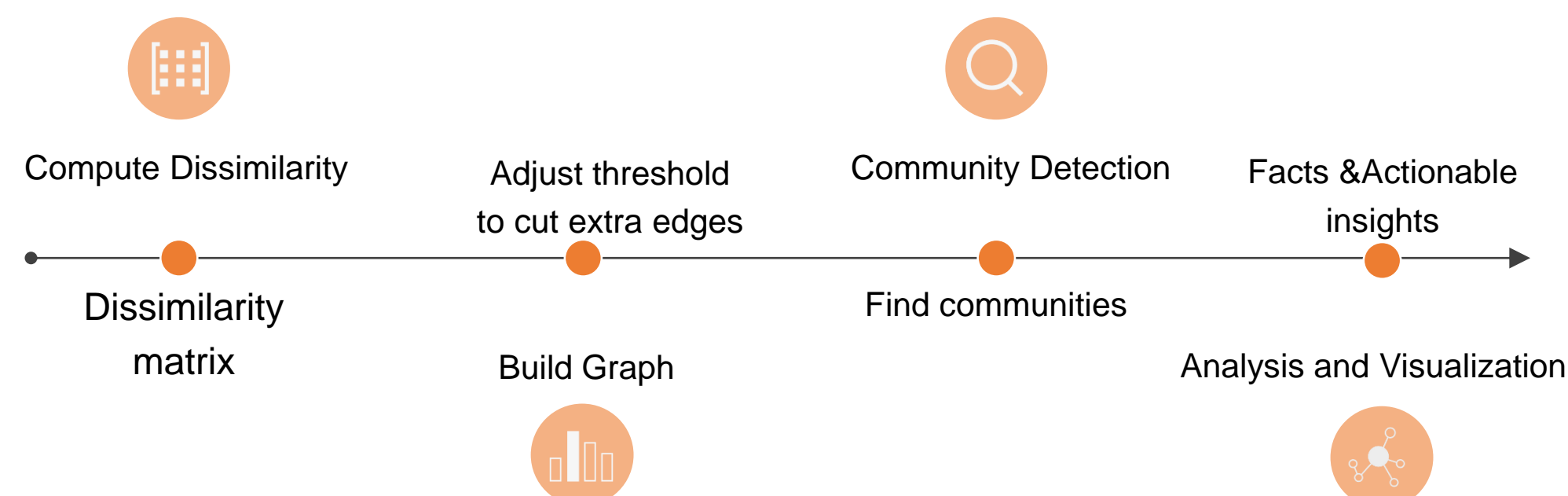
We mainly focus on representative architectural genres around the world, including 40 classes, varying from summer Palace in Asia to Baroque styles in the west. Through neural network and clustered algorithms to observe and analyze the historical relations between different styles.

## / Overview

In our training dataset, we input 40 classes, each of which contains 8 different pictures of the same architecture. Each picture has been modified into a gray one with the same size of 100 times 100. Finally, we really find something interesting and astonished.



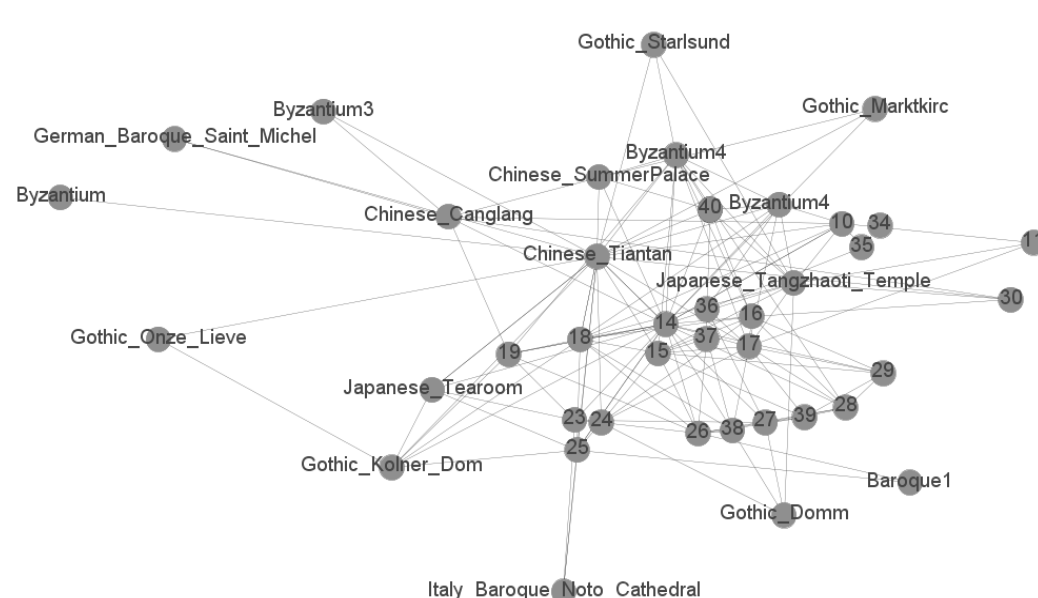
## / Overall Workflow



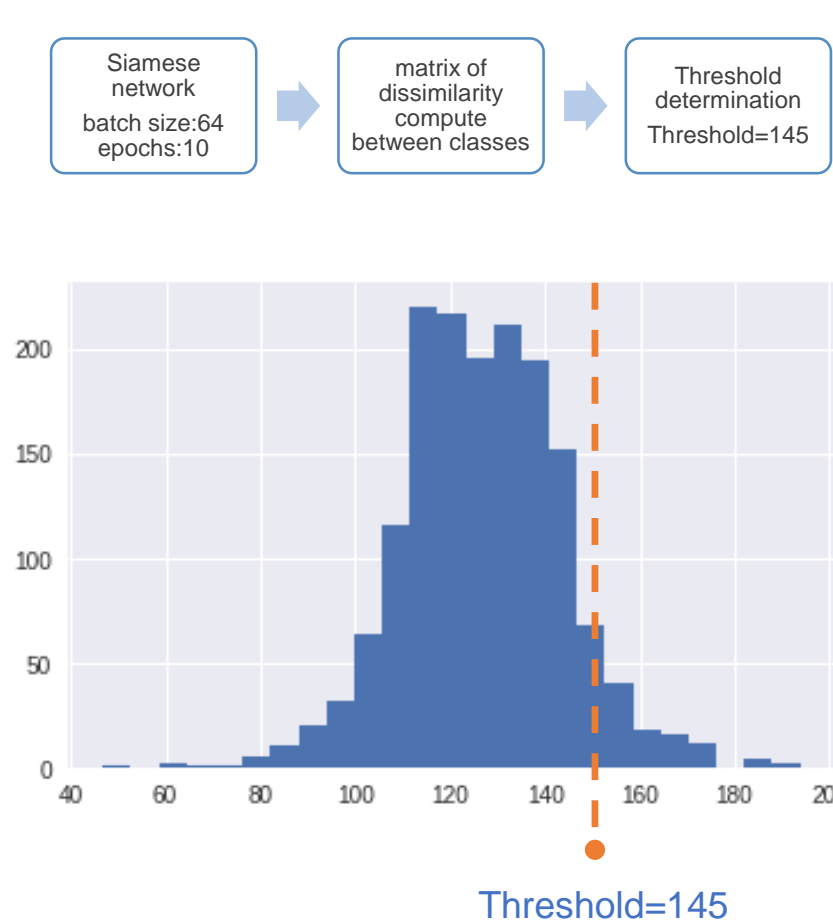
## / Details of Algorithms & Methods Used

### Step 1

Datasets Generation: 40 classes and 8 images of each class

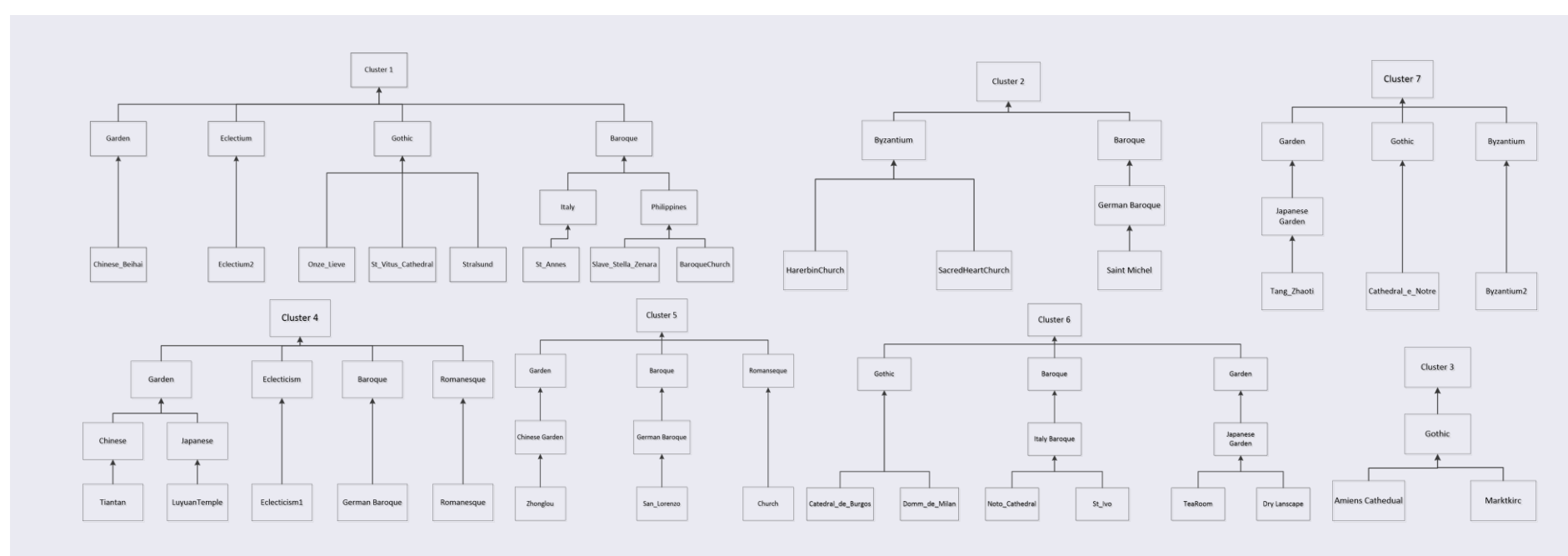


### Step 2



### Step 3 algorithms application

- Single-Linkage



- Markov Clustering

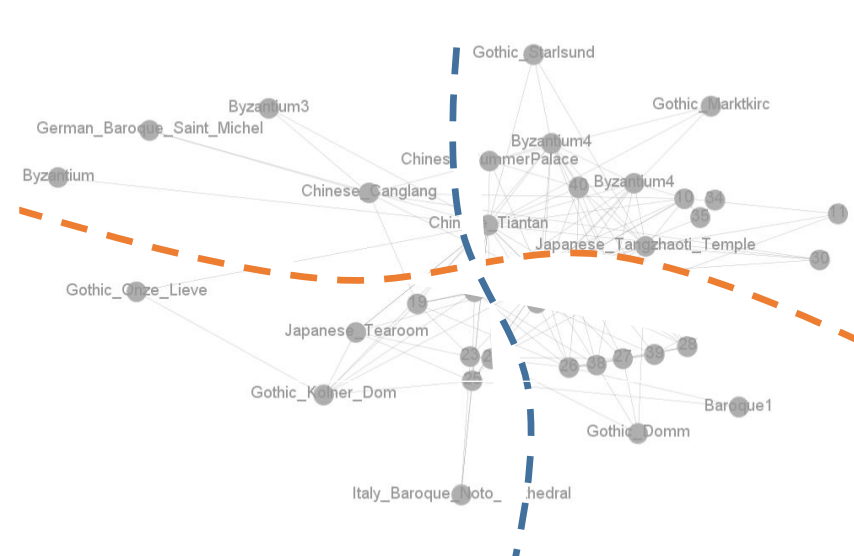
Inflation:

$$(I_r M)_{pq} = (M_{pq})^r / \sum_{i=1}^k (M_{pq})^r$$

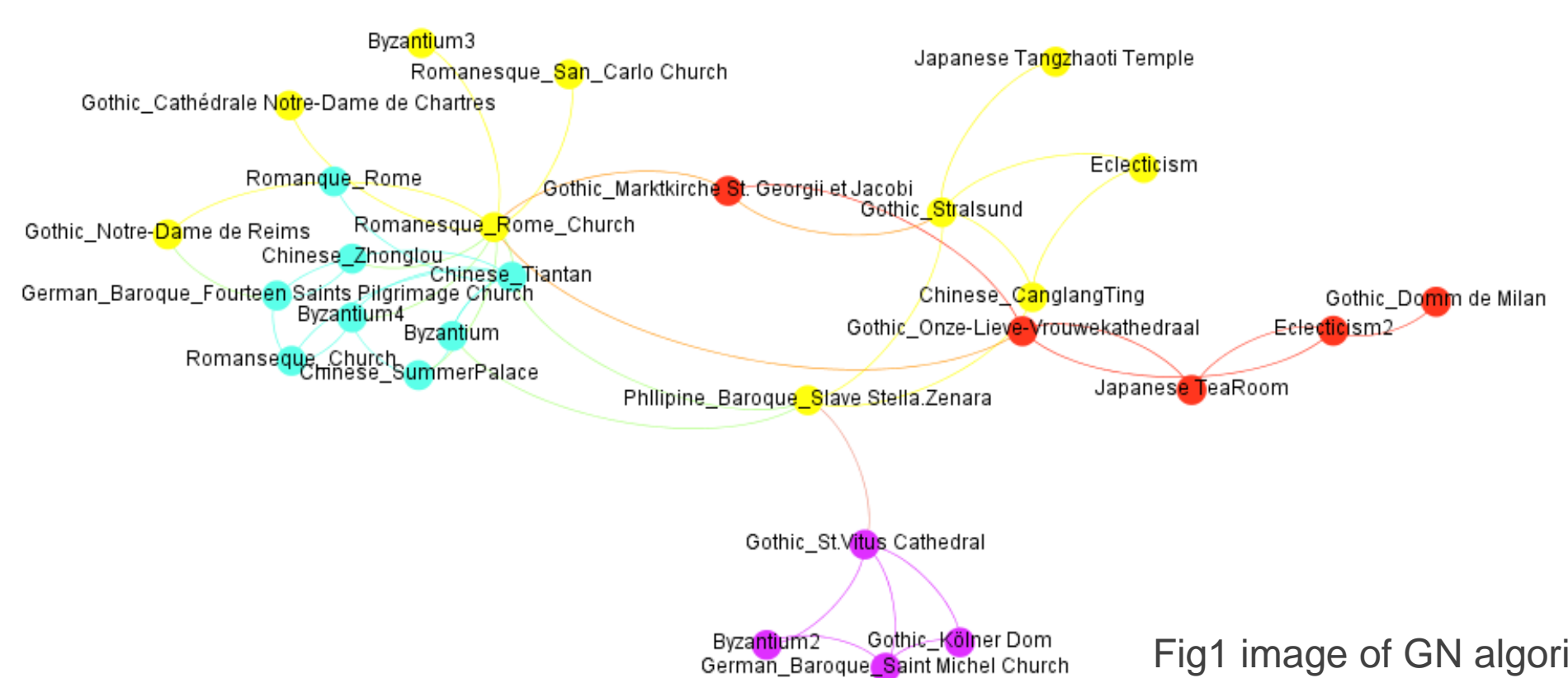
expansion:

$$(M_{pq})' = (M_{pq})^e$$

- Girvan-Newman

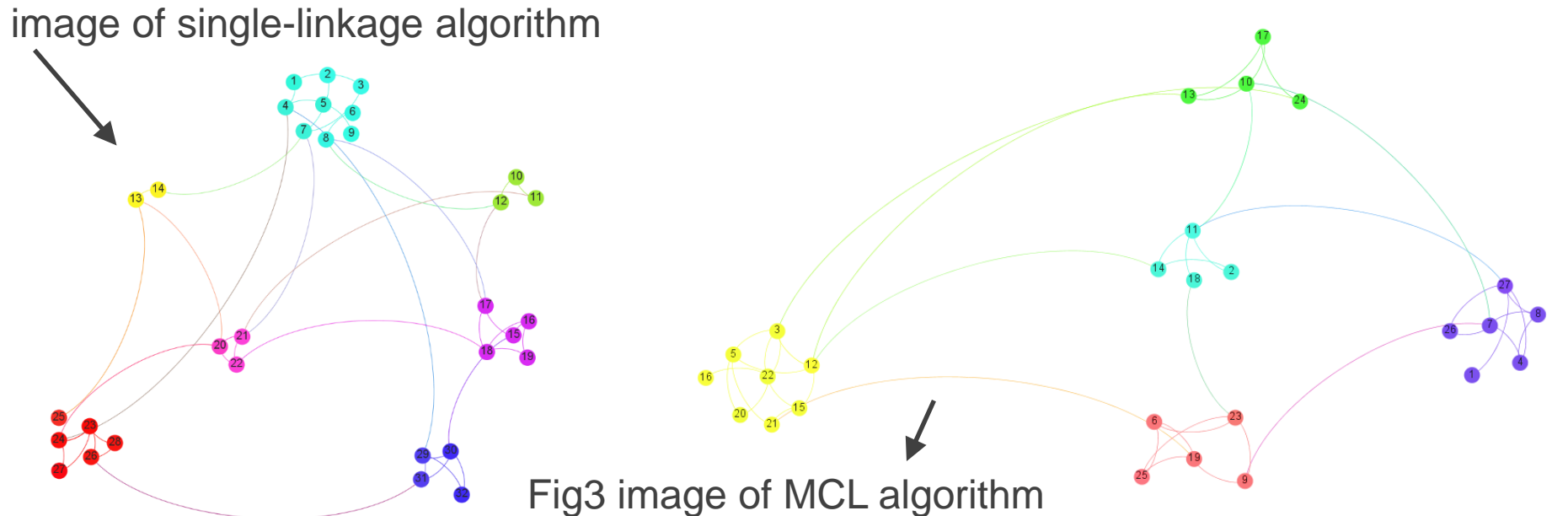


## / Results Obtained



In the image of Girvan Newman algorithm, we could find that Paoay Church, built in Philippines, connected to both Chinese architectures and European architectures. After looking up Philippines history, we discover that church was designed by European architect but was built by Chinese workers, so it combined Chinese and western styles.

Fig2 image of single-linkage algorithm



Through single-linkage algorithm, we could find that the cluster where St. Vitus Cathedral in have both Gothic and Baroque styles. St. Vitus Cathedral was only a Gothic building at the beginning, but architect finished the uncompleted Gothic main tower in Baroque style, so it is a bridge of Gothic and Baroque buildings. It shows the evolution of architectures that buildings of gothic, Baroque and the building between them are in the same cluster. Through MCL algorithm, Schulte Cathedral, Reims Cathedral and Market Church gathered together. The classic period of Gothic architecture was formed in 12-13th century whose representative architecture is Schulte Cathedral. Reims Cathedral was built at the end of the 13th century. These two cathedrals are all in France. Most of the Market Church still maintain the architectural style of the 14th century North Germany. Thus we can see different time periods' Gothic architectures may look differently, but when they are recognized by the machine, they look the same. These architectures witness the evolution of Gothic architectural style.

## / Conclusions & Lessons Learnt

Mixed-style buildings can be inter-class or intra-class connections. The buildings of the same Architecture style, though in different periods, are usually clustered in the same cluster.

Different works of the same architect will appear in one cluster. Architectures in the same region usually look similar with each other.

Some later buildings, which mimic earlier ones, usually share a resemble architecture style with the earlier ones.

