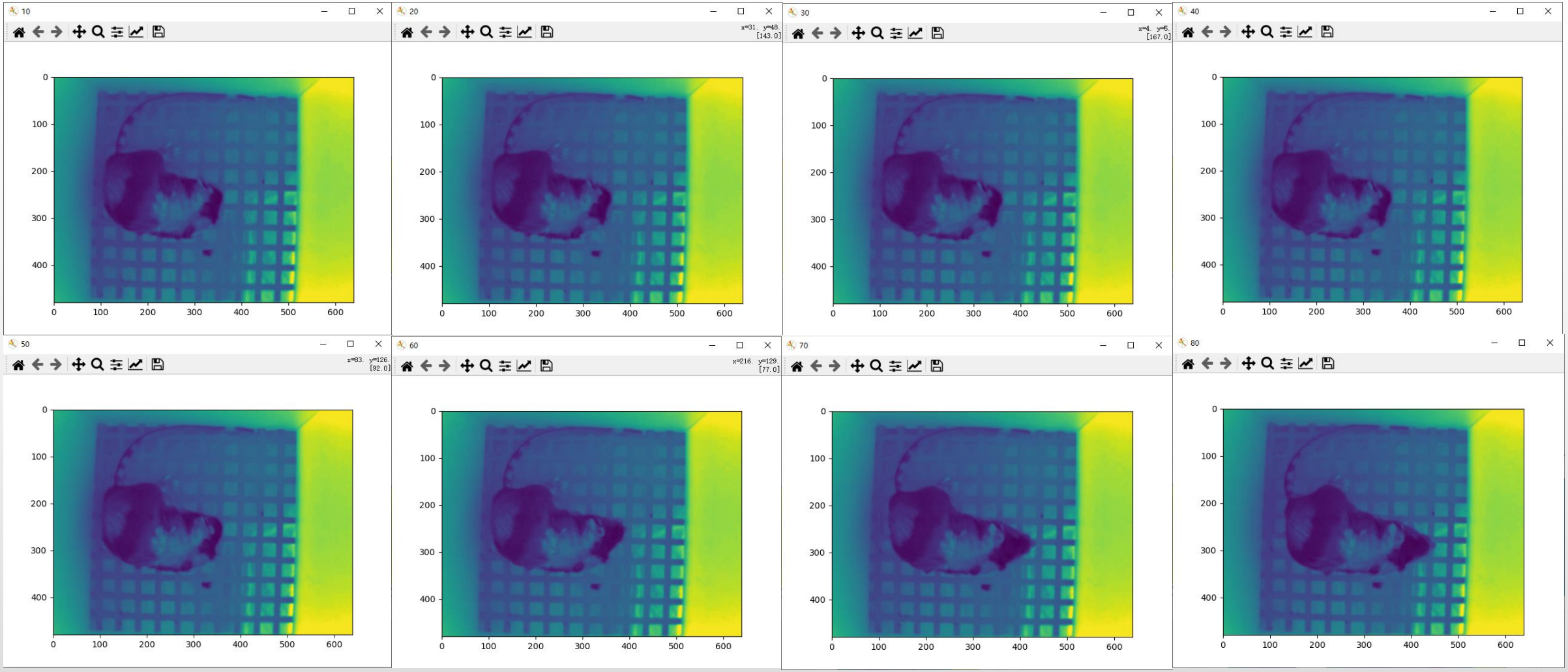
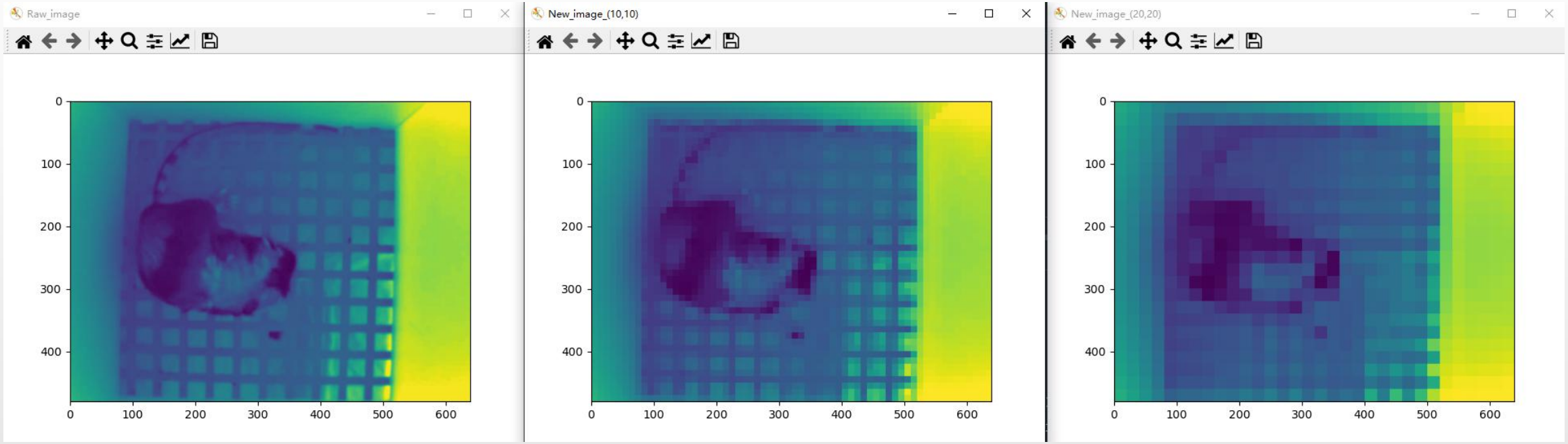
Detection of mice scratching using TDA

raw data



preprocess


Raw_image
New_image_(10,10)
New_image_(20,20)
0
100
200
300
400
500
600

sliding window embedding

image: $\begin{bmatrix} 2 & 4 & 2 \\ 3 & 6 & 11 \\ 9 & 5 & 7 \end{bmatrix}$ → $(2 \quad 4 \quad 2 \quad 3 \quad 6 \quad 11 \quad 9 \quad 5 \quad 7)$

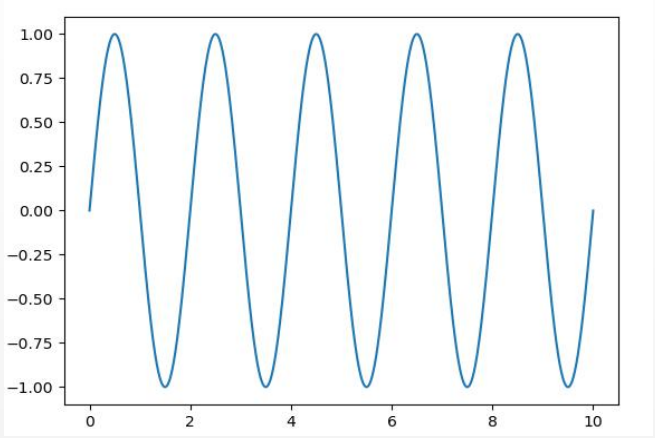
video: $\begin{bmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{bmatrix}$ $\begin{bmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & a_{32} & b_{33} \end{bmatrix}$ $\begin{bmatrix} c_{11} & c_{12} & c_{13} \\ c_{21} & c_{22} & c_{23} \\ c_{31} & c_{32} & c_{33} \end{bmatrix}$ $\begin{bmatrix} d_{11} & d_{12} & d_{13} \\ d_{21} & d_{22} & d_{23} \\ d_{31} & d_{32} & d_{33} \end{bmatrix}$ … …

time

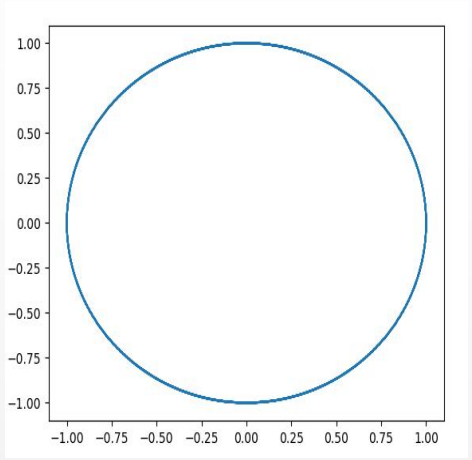
t=1 t=2 t=3 t=4 … …

→ point cloud: $(a_{11} \quad \cdots \quad b_{11} \quad \cdots \quad c_{11} \quad \cdots)$, $(b_{11} \quad \cdots \quad c_{11} \quad \cdots \quad d_{11} \quad \cdots)$, …

TDA for periodic data

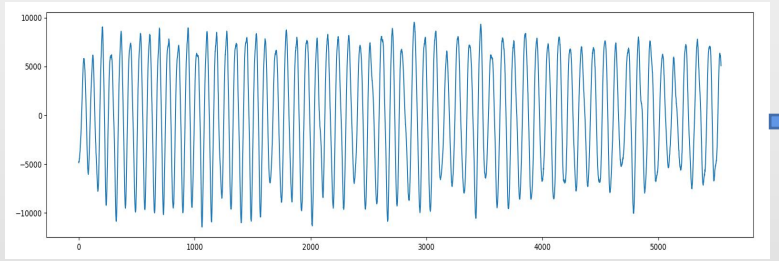


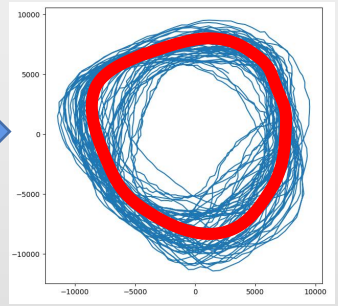
realization

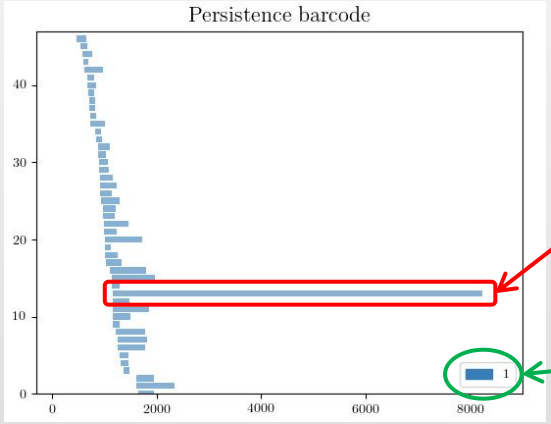


computation

$$H_k(circle) = \begin{cases} \mathbb{Z}, & k = 0 \\ \mathbb{Z}, & k = 1 \\ 0, & k > 1 \end{cases}$$





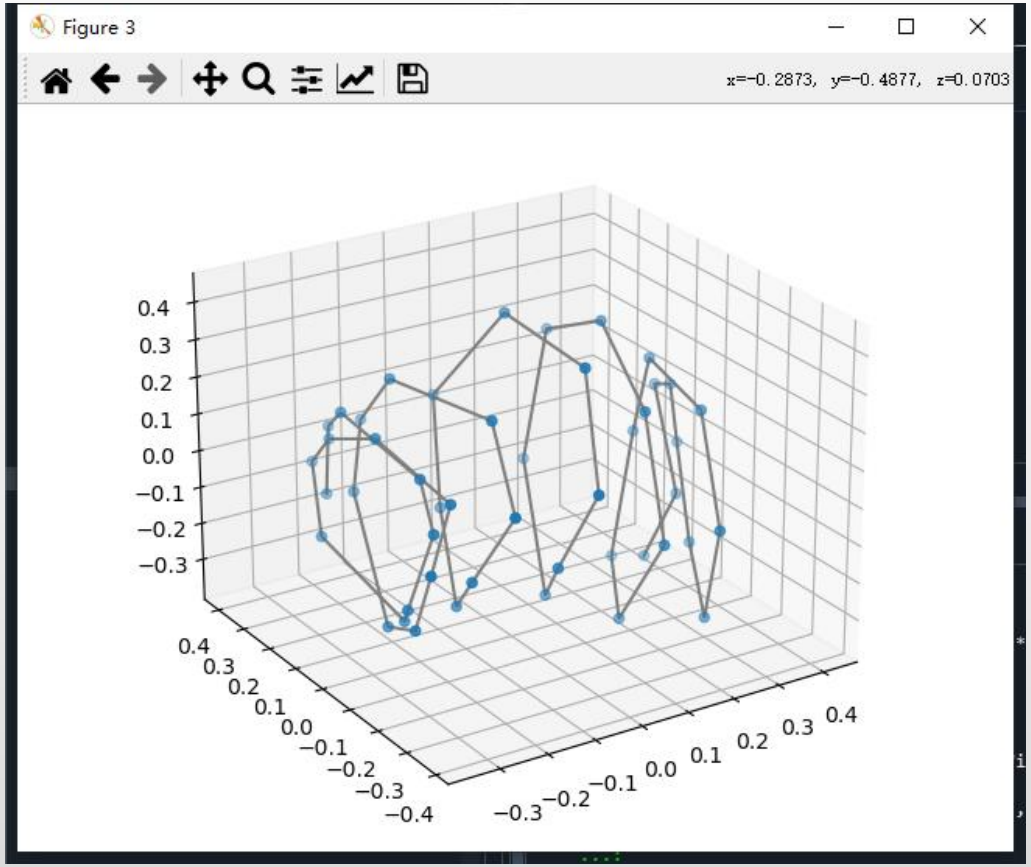


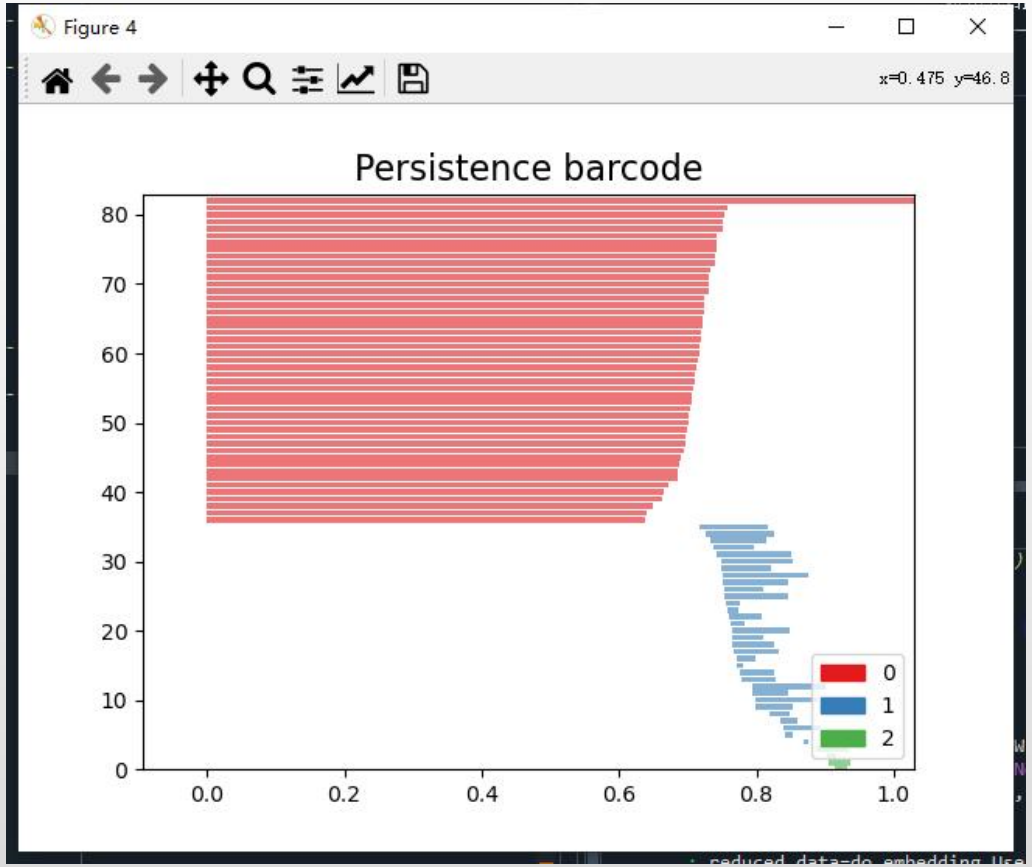
A long barcode indicates an essential one-dimensional hole.

Dimension of homology group

results

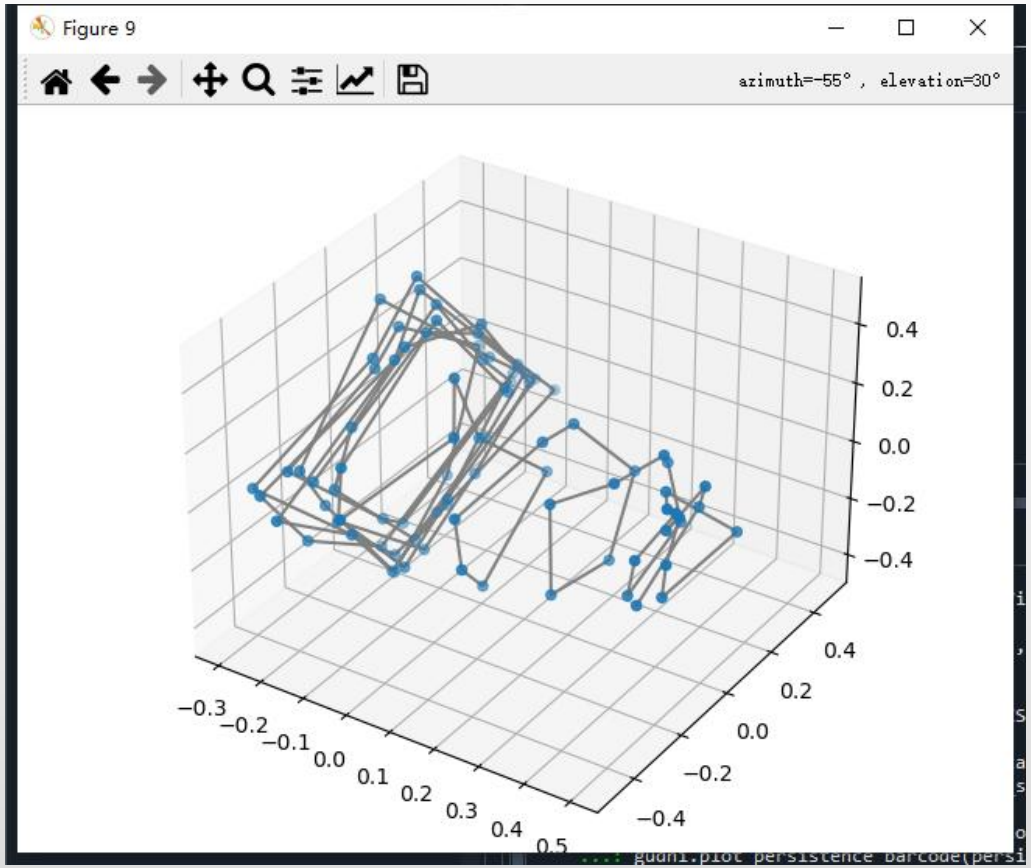
- Positive//202206020911-1_00-419-62409-62566.mkv
- Msize=(10,10), dim=4, Tau=5, dT=1, XOrig[90:]

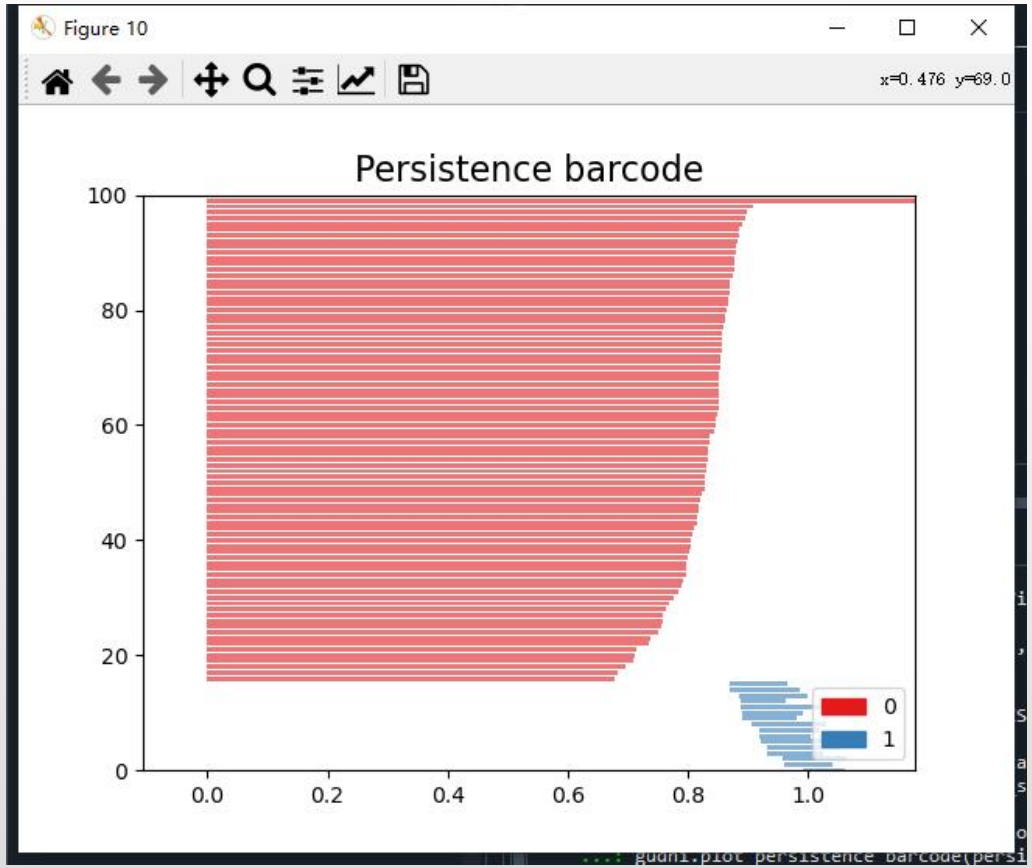




results

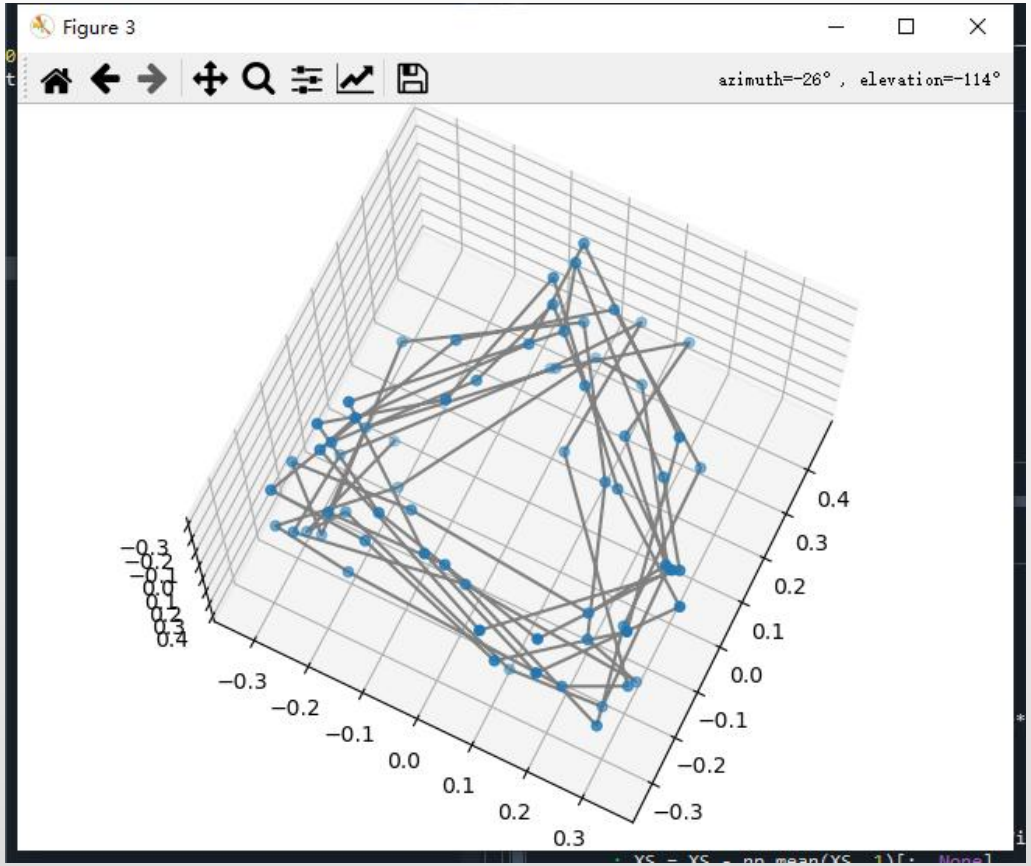
- positive\\202206020911-0_04-30-10002-10226.mkv
- Msize=(10,10), dim=4, Tau=5, dT=1, XOrig[120:]

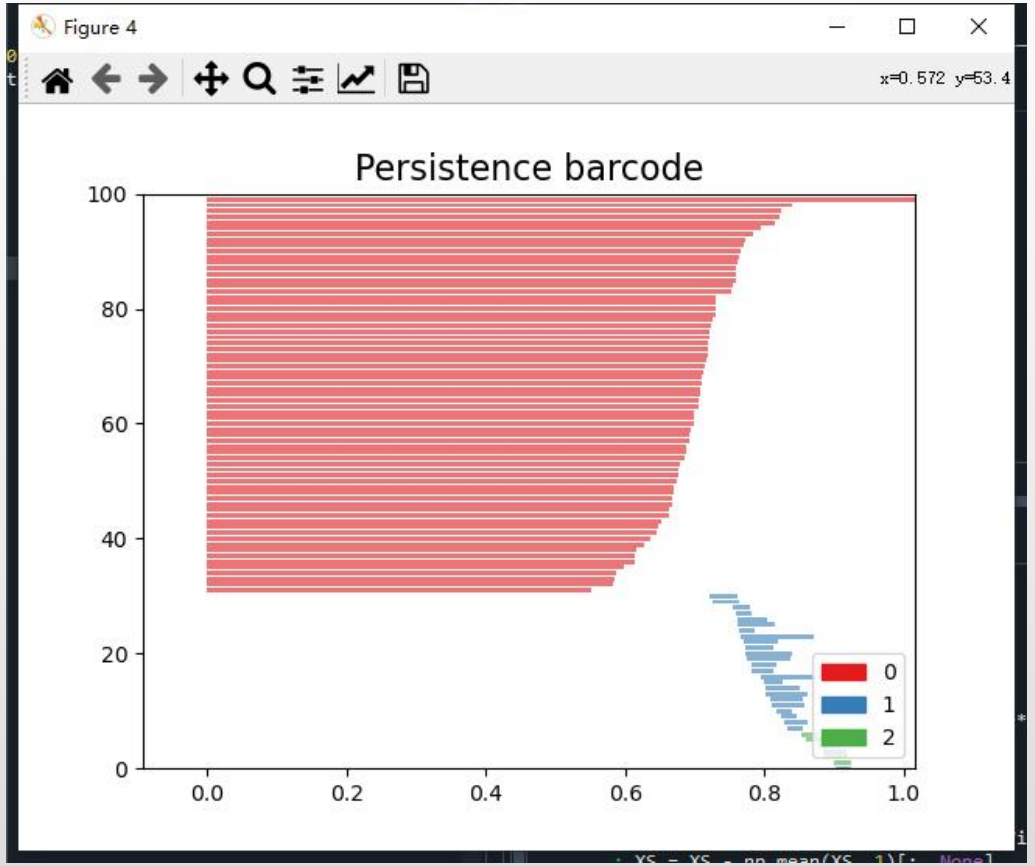




results

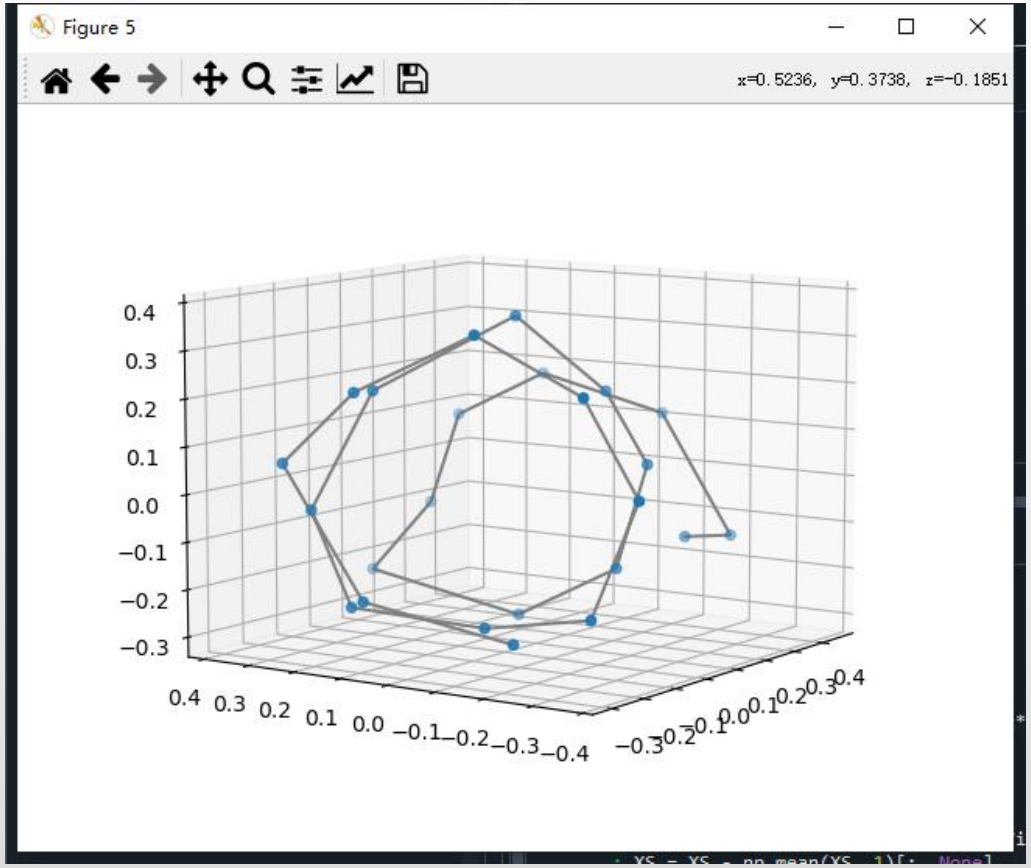
- Positive//202206020911-1_02-29-5381-5555.mkv
- Msize=(10,10), dim=4, Tau=5, dT=1, XOrig[:120]

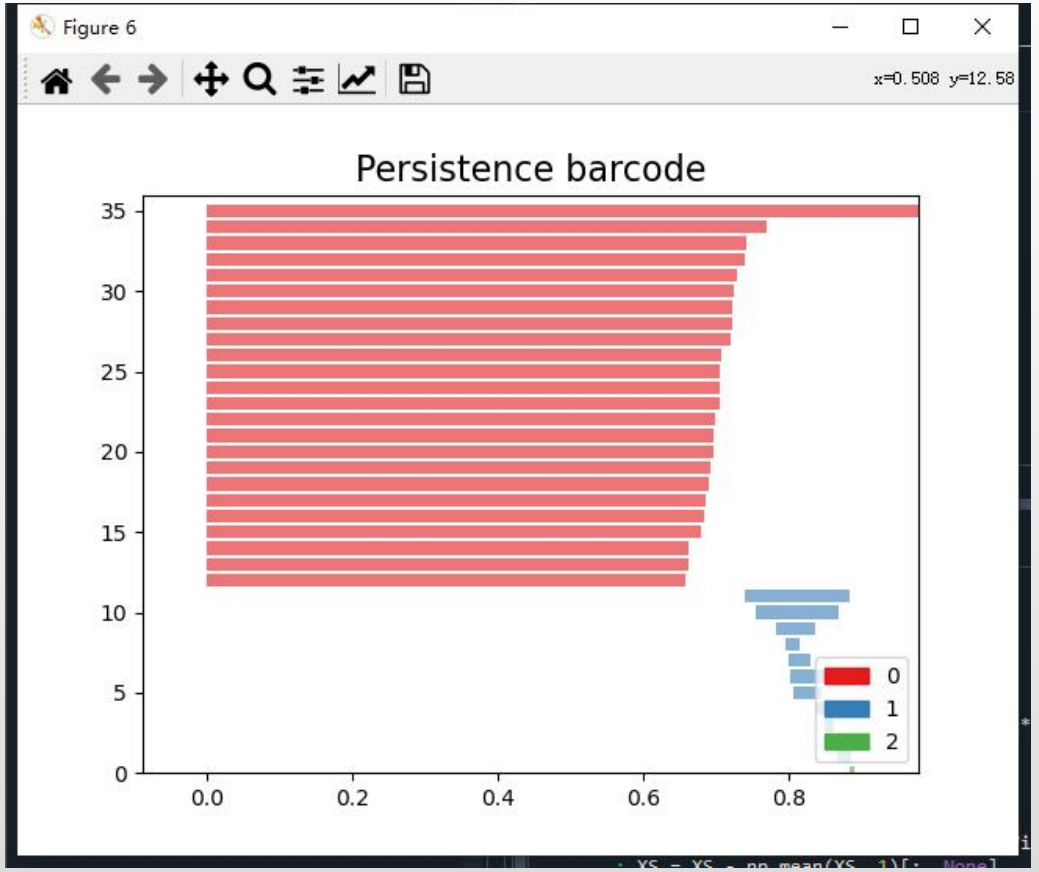




results

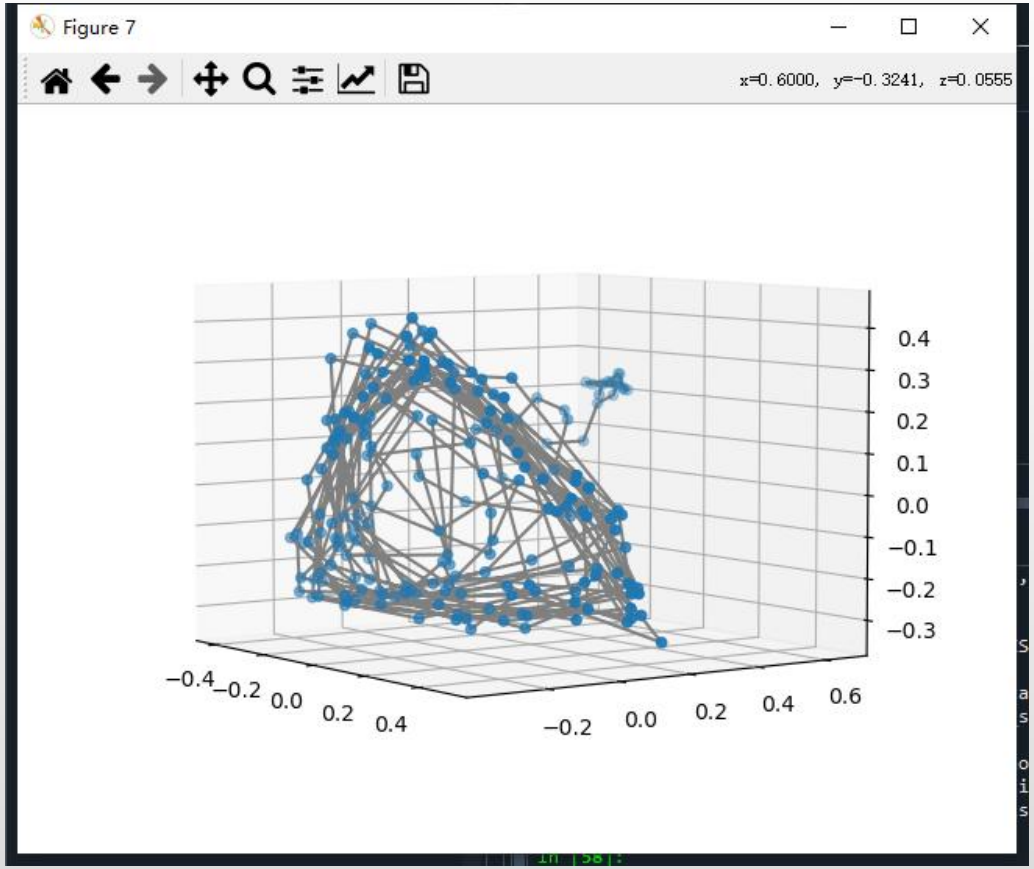
- Positive//202206020911-1_00-165-24062-24198.mkv
- Msize=(10,10), dim=5, Tau=6, dT=1, XOrig[70:130]

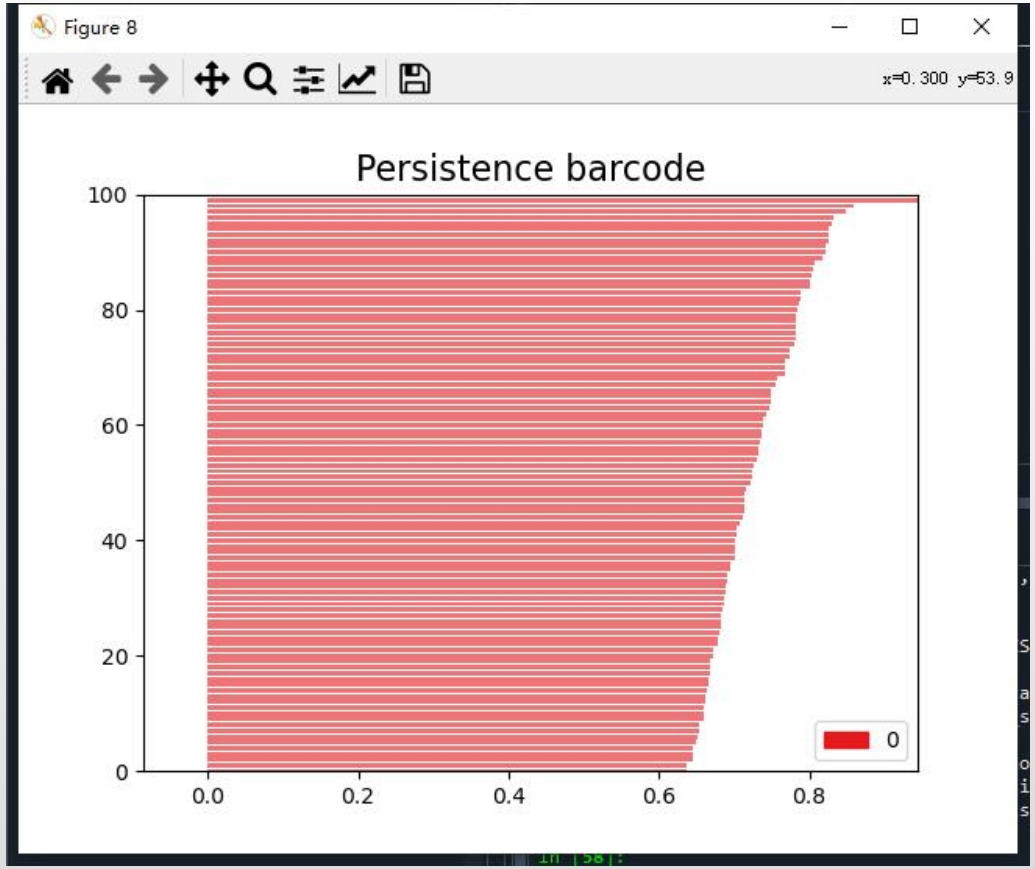




results

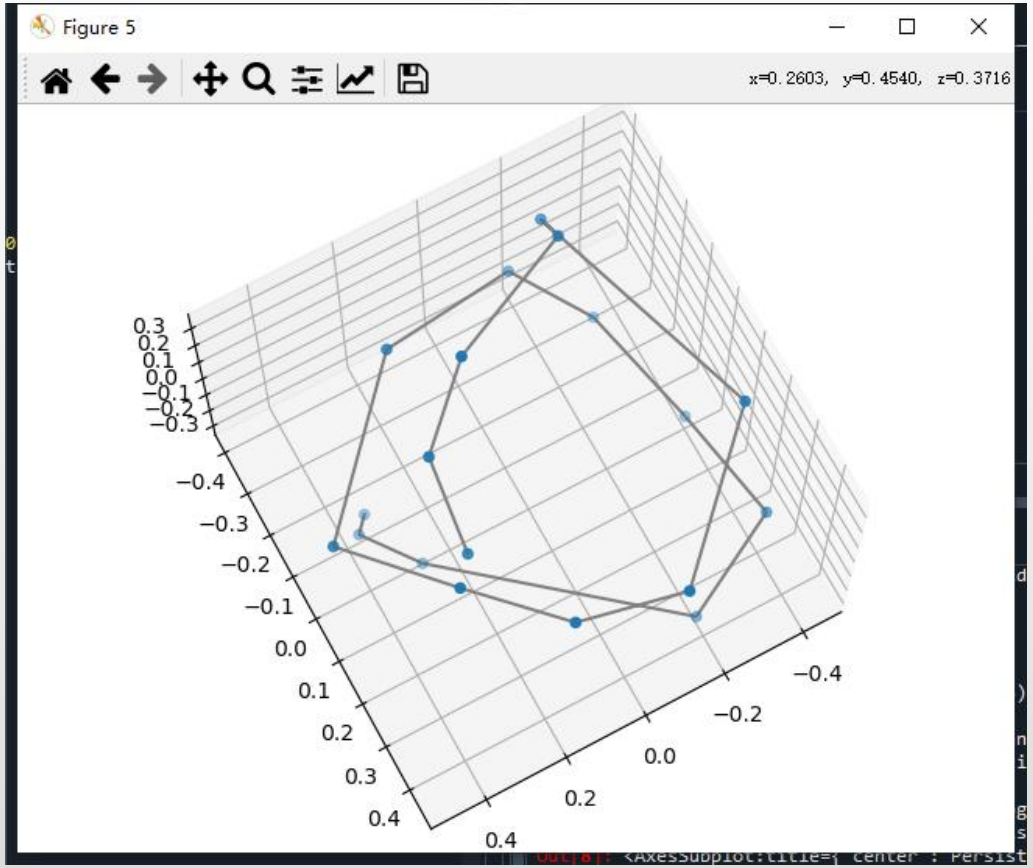
- Positive//202206020911-0_02-120-55220-55473.mkv
- Msize=(10,10), dim=4, Tau=5, dT=1, XOrig[30:]

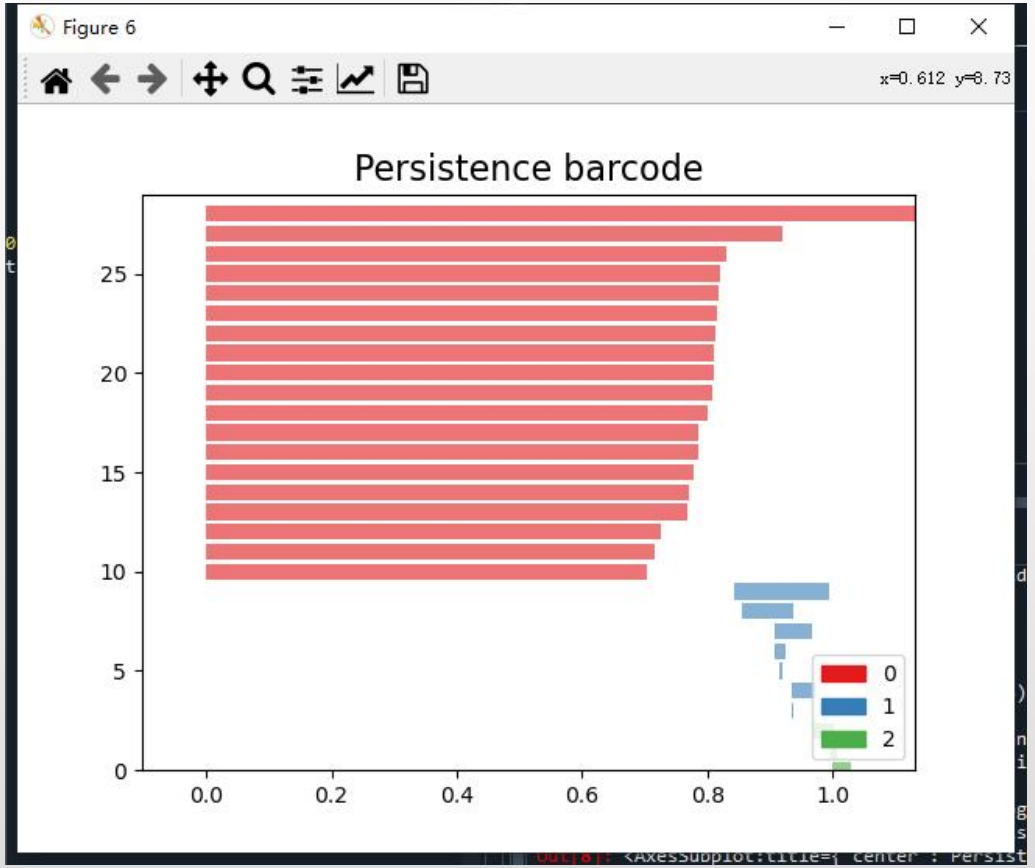




results

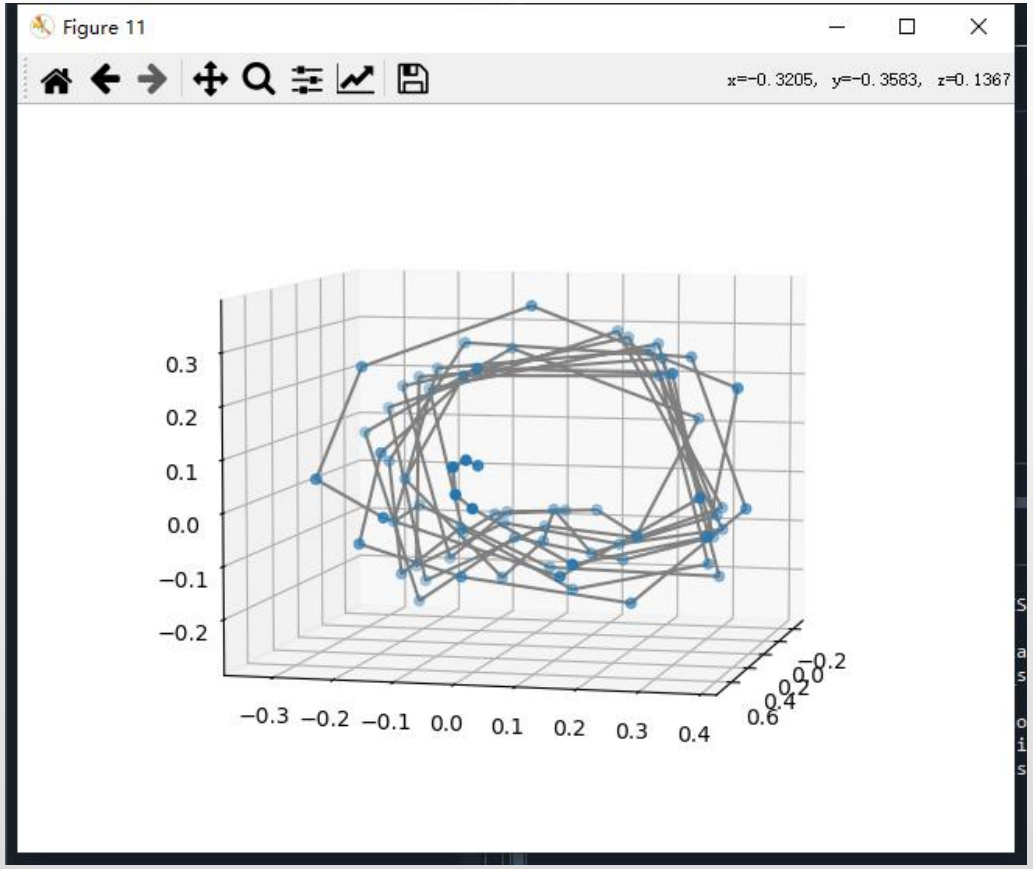
- Positive//202206020911-1_01-295-46491-46603.mkv
- Msize=(10,10), dim=4, Tau=5, dT=1, XOrig[40:80]

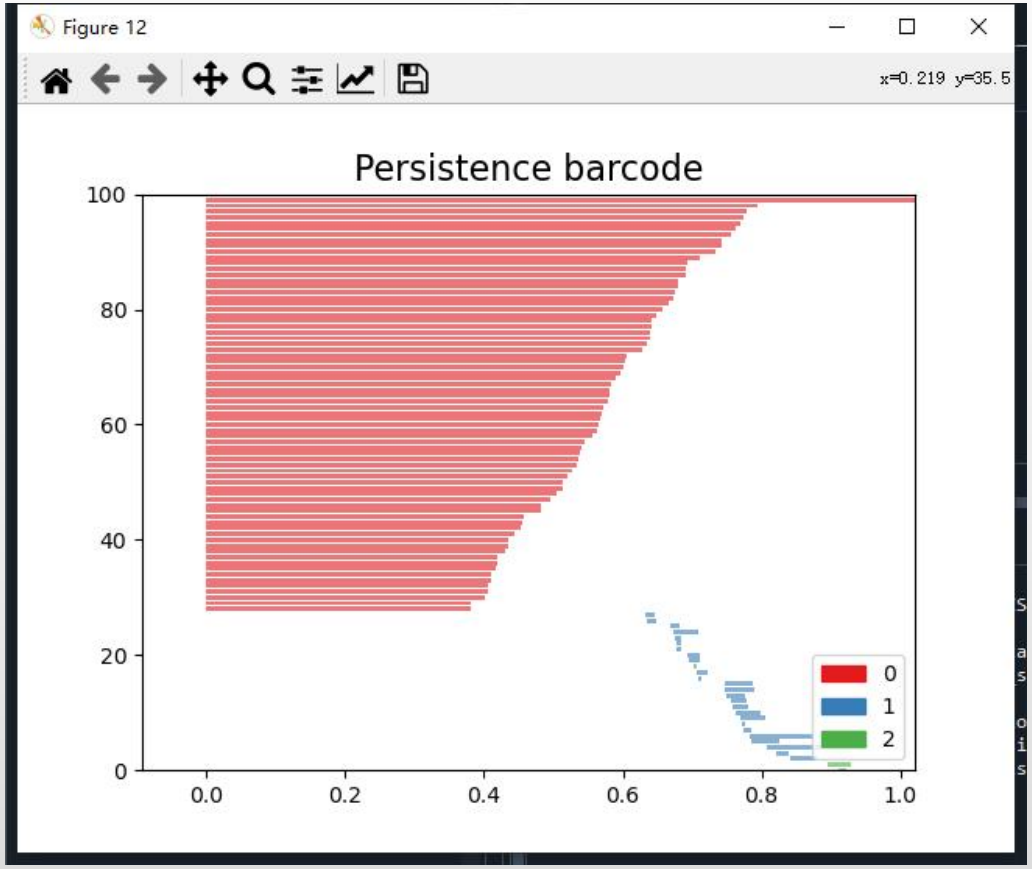




results

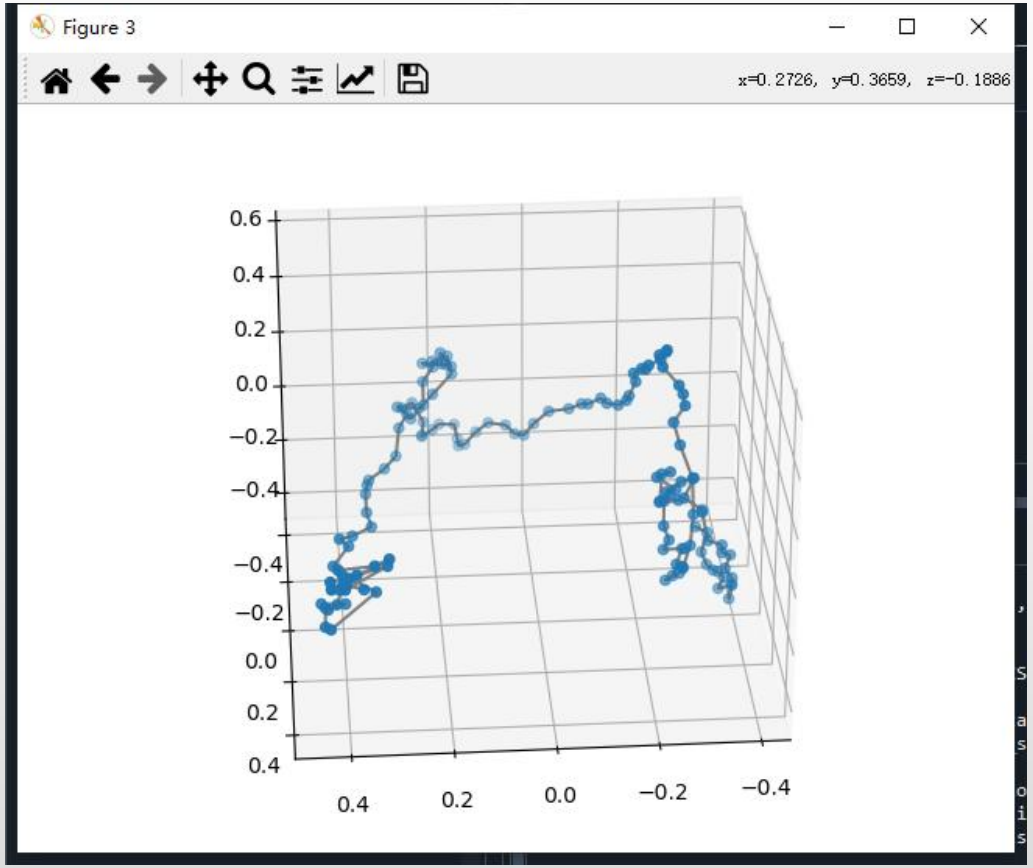
- Positive//202206020911-1_01-191-30651-30757.mkv
- Msize=(10,10), dim=4, Tau=1, dT=1, XOrig[30:]

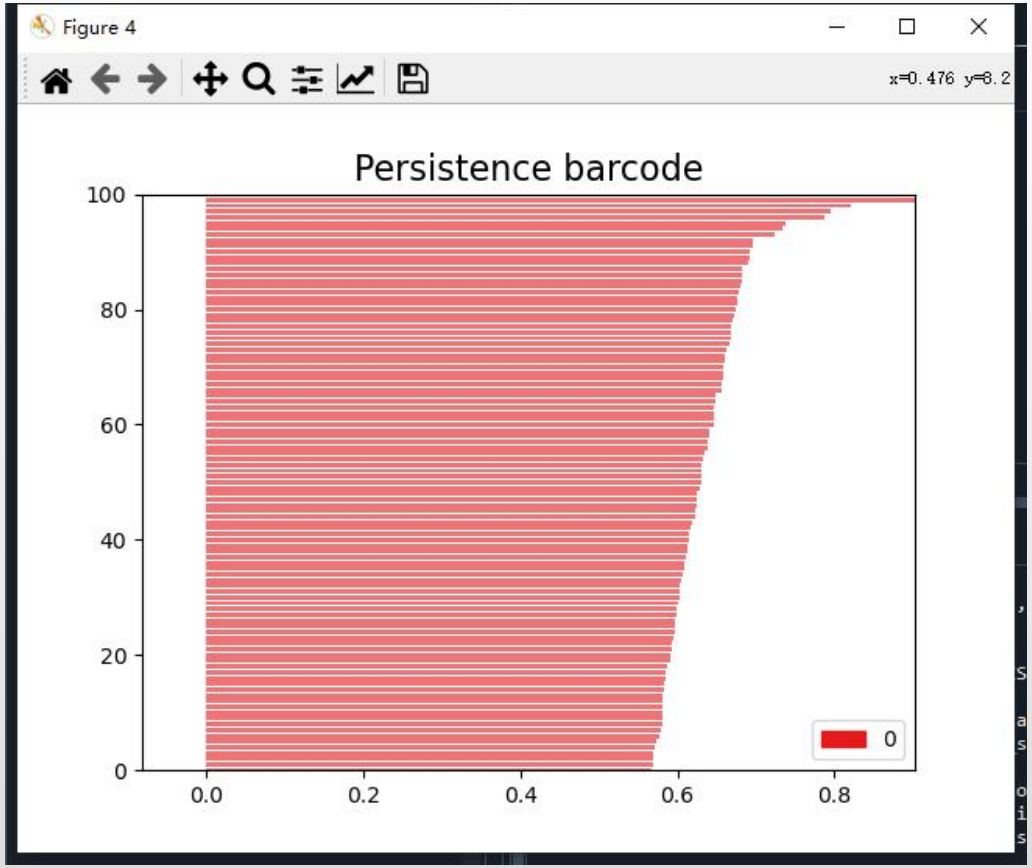




results

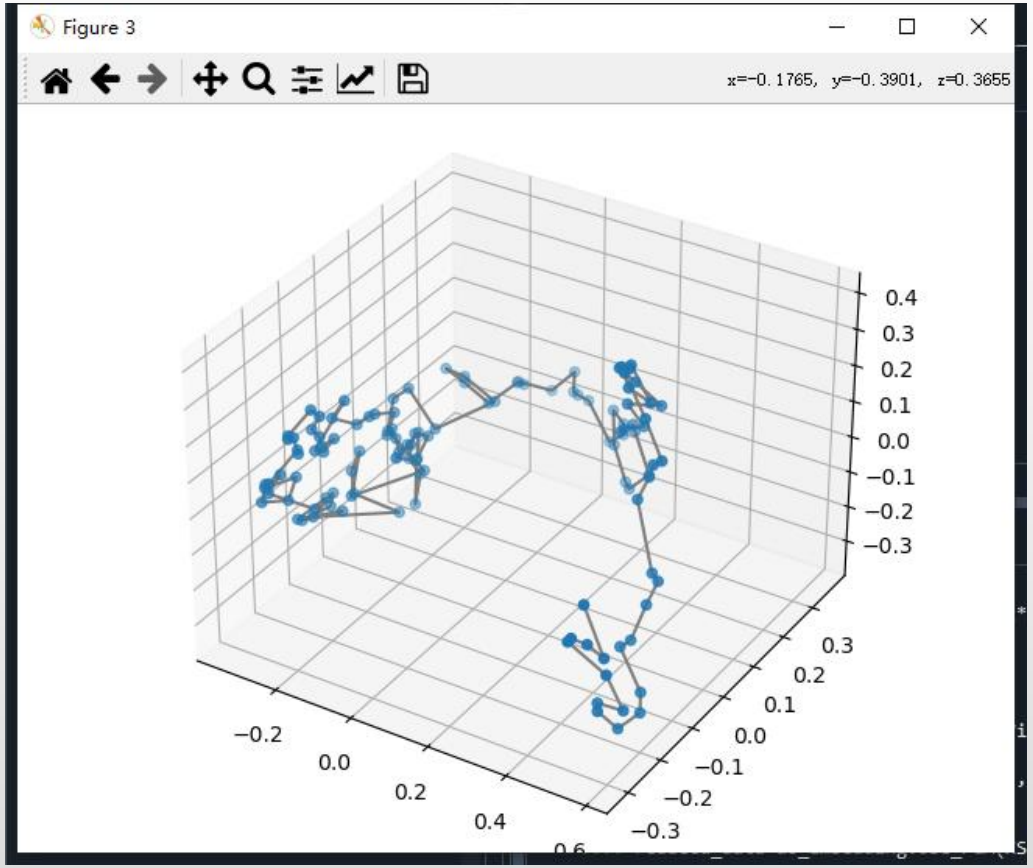
- Negative//202206021338-1_01-86-13545-13704.mkv
- Msize=(10,10), dim=4, Tau=5, dT=1

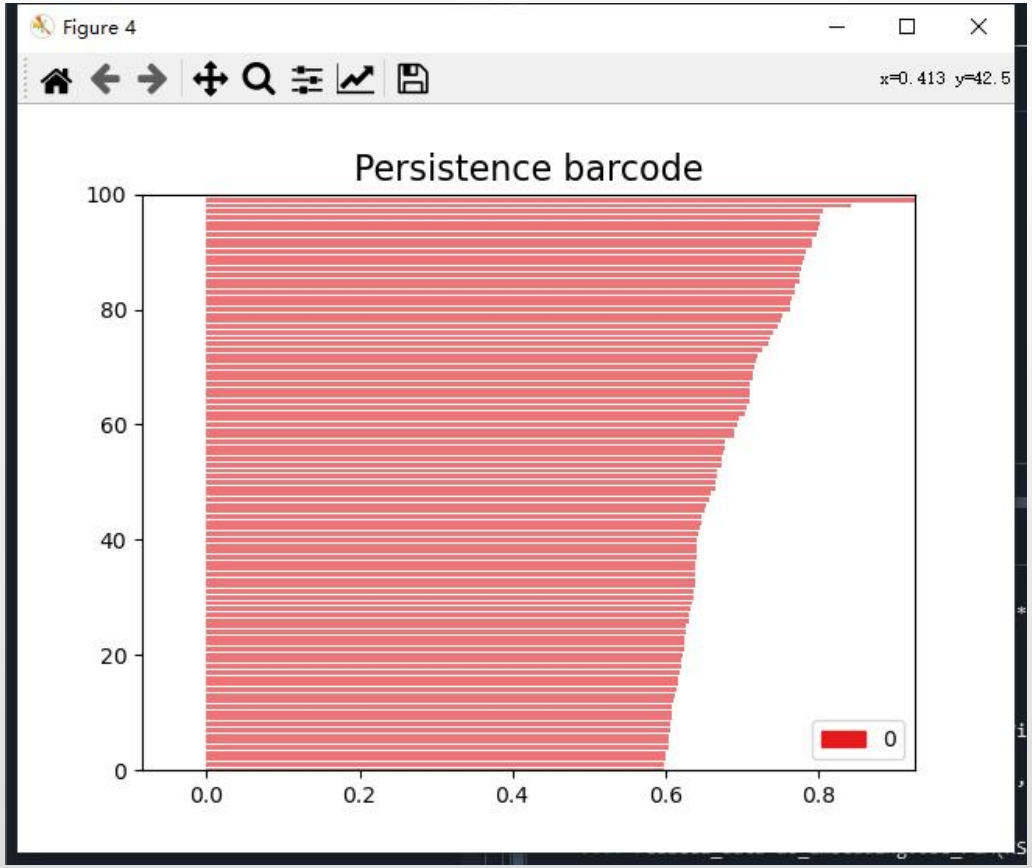




results

- Negative//202206021135-1_04-1-33-172.mkv
- Msize=(10,10), dim=4, Tau=5, dT=1





results

- Negative//202206021135-1_02-167-51550-51685.mkv
- Msize=(10,10), dim=4, Tau=5, dT=1