# Nonlinear Dynamics: Mathematical and Computational Approaches

Lead instructor: Liz Bradley

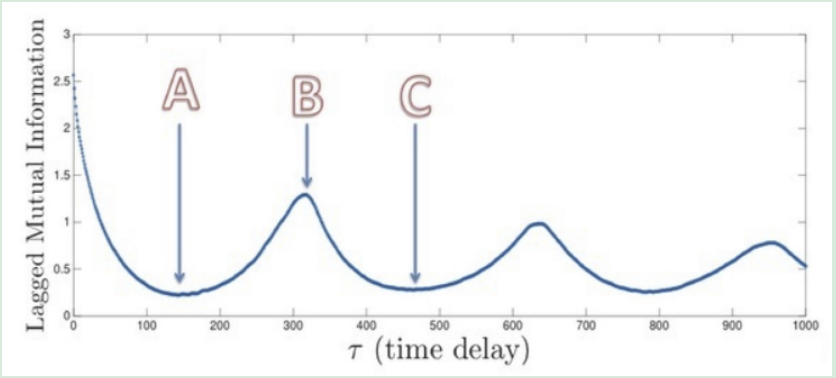


**Quiz scores are NOT recorded.**

- You may come back to quizzes and take them as many times as you like
- When you are finished, clicking the "Score" button at the bottom of the test will show you the correct responses.

**Question 1**

Below is a plot of the mutual information of a time series as a function of the time delay τ:




Using the mutual information heuristic of Fraser & Swinney proposed in "Independent coordinates for strange attractors from mutual information" -- the heuristic discussed in the video for this segment -- what τ value should be chosen for a correct embedding?

✔ A. A
B. B
C. C

**Question 2**

The τ suggested by this heuristic is the *only* τ that will provide a faithful reconstruction according to Takens theorem.

A. True
✔ B. False

**Question 3**

What is the logic behind choosing τ at the value marked "A" in the figure?

A. Minimizing shared information between coordinates while allowing enough lag between coordinates to 'unfold' the dynamics more fully.
✔ B. The smallest τ that minimizes the shared information between coordinates.
C. Maximizing shared information between coordinates while obeying the theoretical ($\tau \to 0$) constraints.

**Question 4**

What is the logic behind choosing τ at the value marked "B" in the figure?

✖ A. Minimizing shared information between coordinates while allowing enough lag between coordinates to 'unfold' the dynamics more fully.
B. The smallest τ that minimizes the shared information between coordinates.
C. Maximizing shared information between coordinates while obeying the theoretical ($\tau \to 0$) constraints.

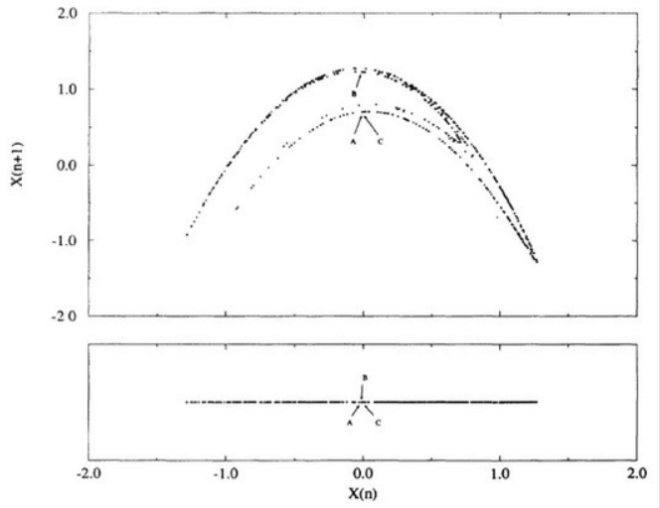
**Question 5**

What is the logic behind choosing τ at the value marked "C" in the figure?

- A. Minimizing shared information between coordinates while allowing enough lag between coordinates to 'unfold' the dynamics more fully.
- B. The smallest τ that minimizes the shared information between coordinates.
- ✖ C. Maximizing shared information between coordinates while obeying the theoretical ($\tau \to 0$) constraints.

**Question 6**

In the following figure (taken from the original paper on the false near neighbor method), which pairs of points would be considered "false neighbors"?




- I. A and C
- II. A and B
- III. B and C
- IV. A, B, and C
- ✔ V. II and III
- VI. None of the above

**Question 7**

If the ratio of false-near(est) neighbors between dimension *m* and dimension *m*+1 is less than 10%, that provides theoretical proof that *m* satisfies the conditions of the Takens theorem and that the reconstructed attractor is diffeomorphic to the original attractor.

- A. True
- ✔ B. False

You got 5 out of 7 questions correct Reset