# TDA BREAKOUT: DAY 2 WORKSHEET

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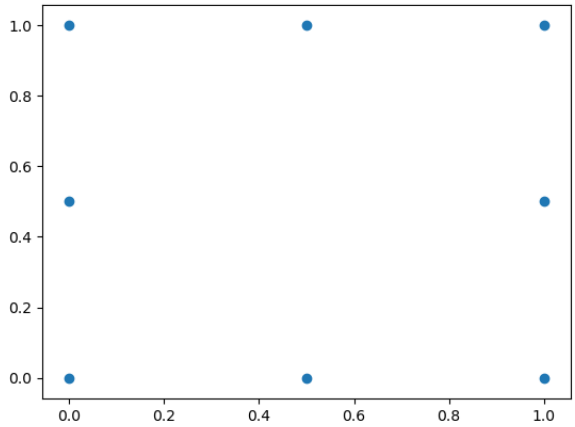
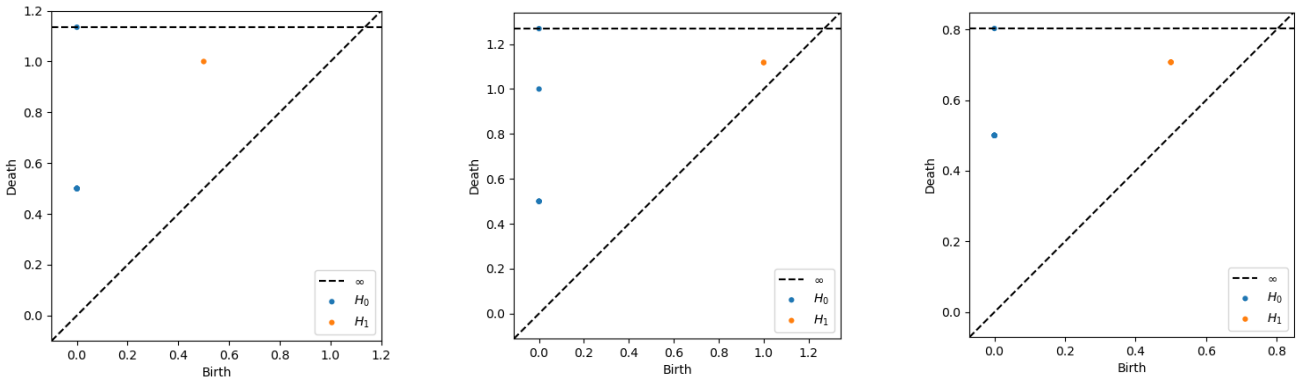
## 1. Rips complexes

Consider the following point cloud:




- Using the usual Euclidean distance, draw (roughly) the Vietoris-Rips complexes $V_{0.25}$, $V_{0.5}$ and $V_2$.
- What is the least $x \in [0, 2]$ for which the Vietoris-Rips complex has one connected component? What is the zeroth Betti number $\beta_0$ for this complex?
- What is the least $x \in [0, 2]$ for which the Vietoris-Rips complex has a "hole"? In other words, what is the least $x$ for which the first Betti number of $V_x$ is non-zero?
- What is the *greatest* $x$ for which the Vietoris-Rips complex has a "hole"? In other words, what is the greatest $x$ for which the first Betti number of $V_x$ is non-zero?
- Which of the persistence diagrams below matches the point cloud? The little numbers represent the multiplicities of the points (when greater than 1).
- Of the two remaining diagrams, one comes deleting the points $(0, 0.5)$ and $(1, 0.5)$, and one comes from adding the point $(0.5, 0.5)$. Can you tell which is which?

*Date*: June 24, 2019.




## 2. Computational investigations

Go to `www.github.com/thomasweighill/VRDI_TDA_Breakout` and go through the notebooks there, which are based on notebooks provided by T. Needham.