

Topological patterns in data

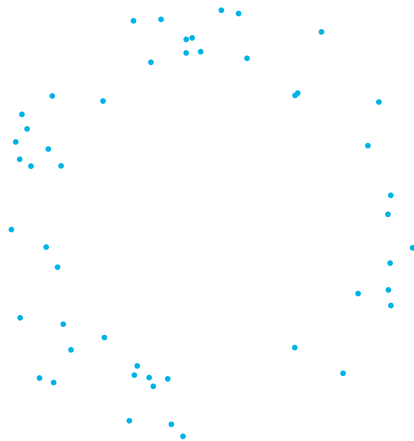
EPSRC Hub seminar

14 November 2019

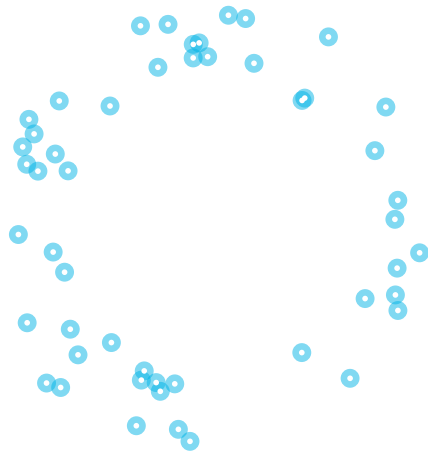
Jānis Lazovskis
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Slides available online at
jlazovskis.com/math

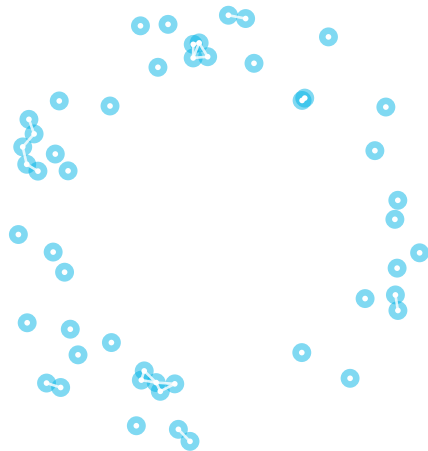
Interpreting a data set



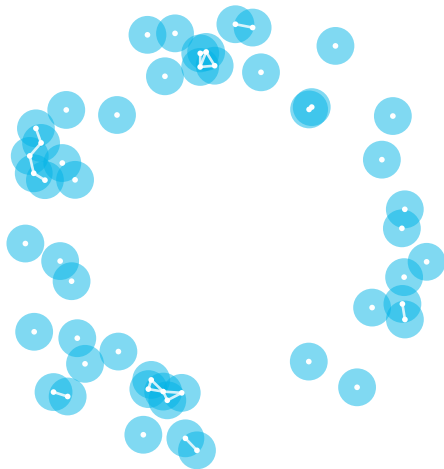
Interpreting a data set



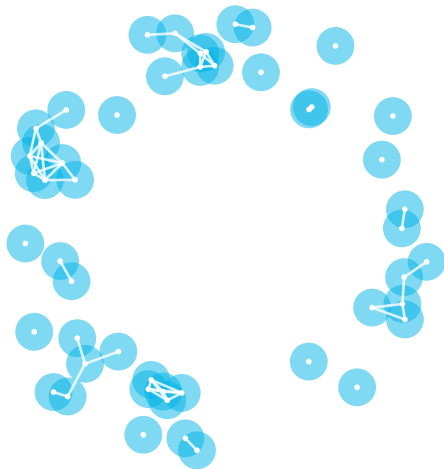
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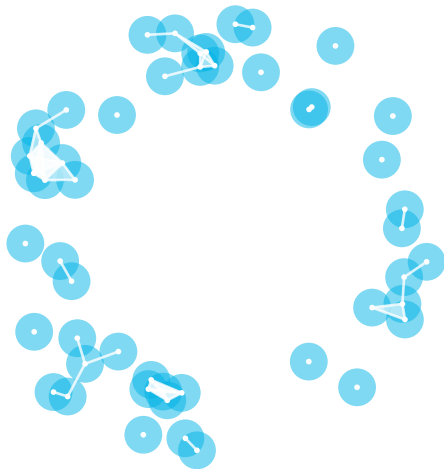
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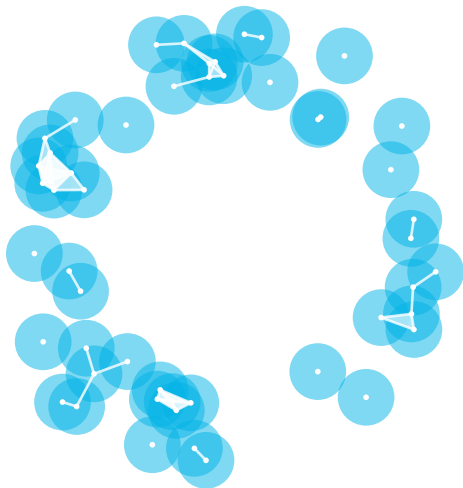
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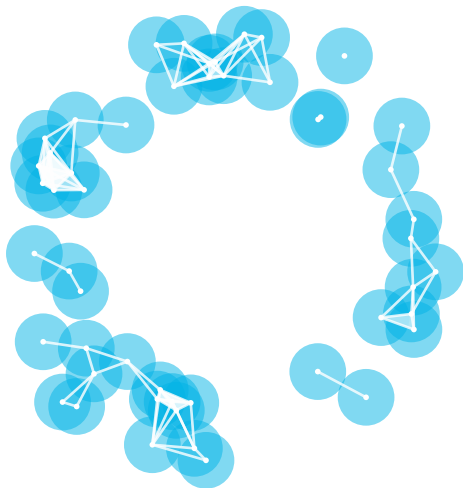
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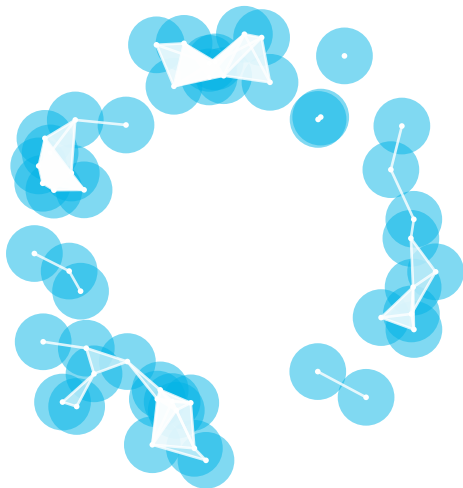
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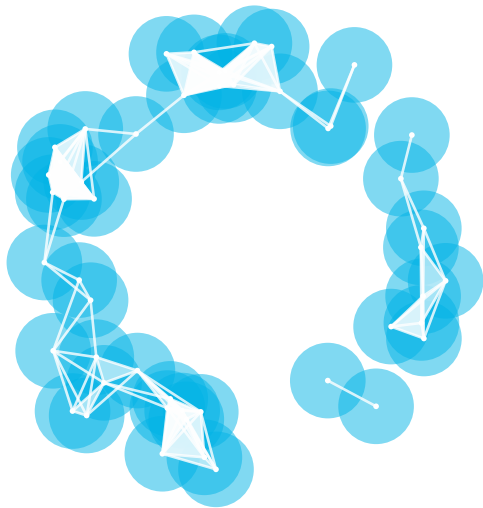
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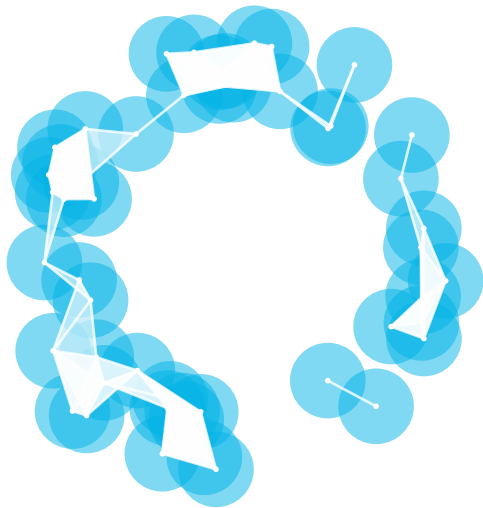
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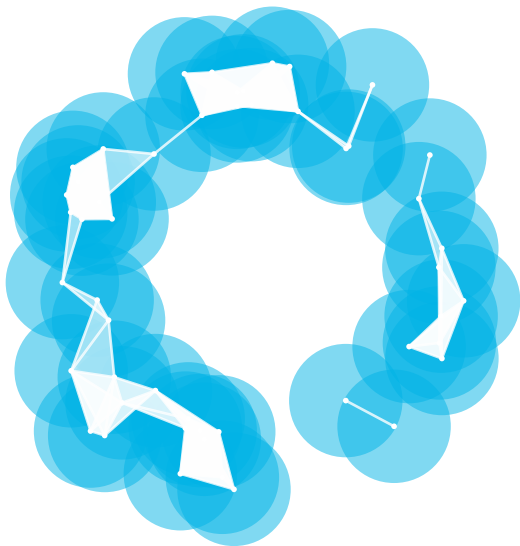
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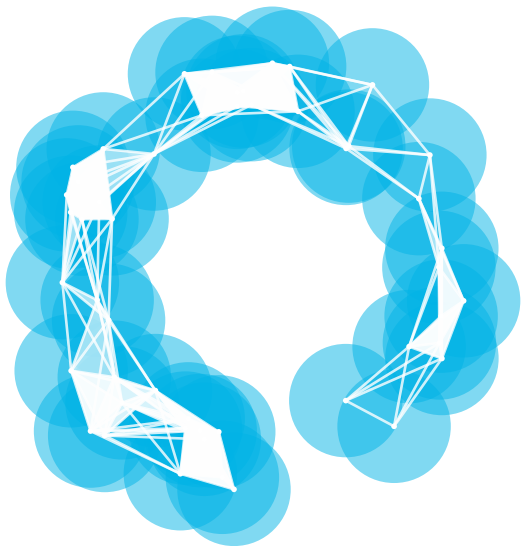
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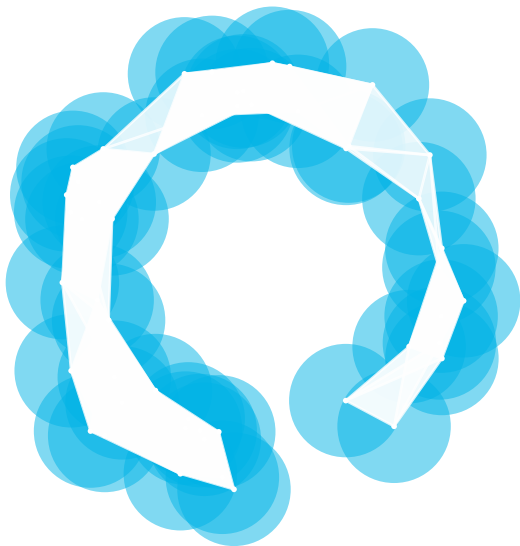
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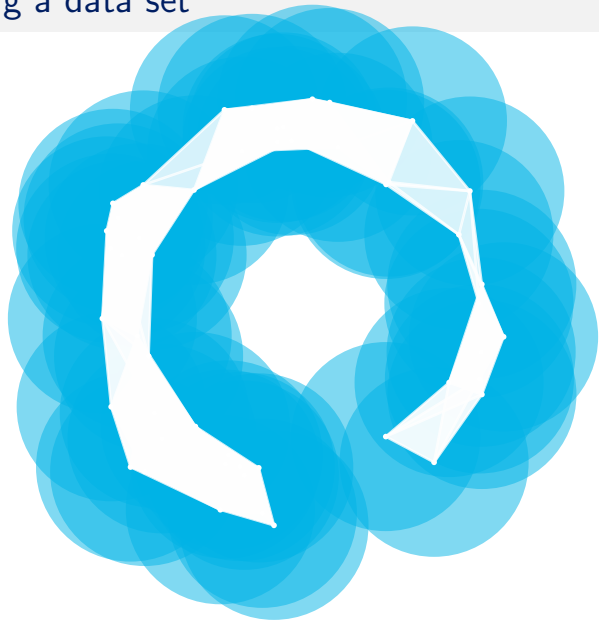
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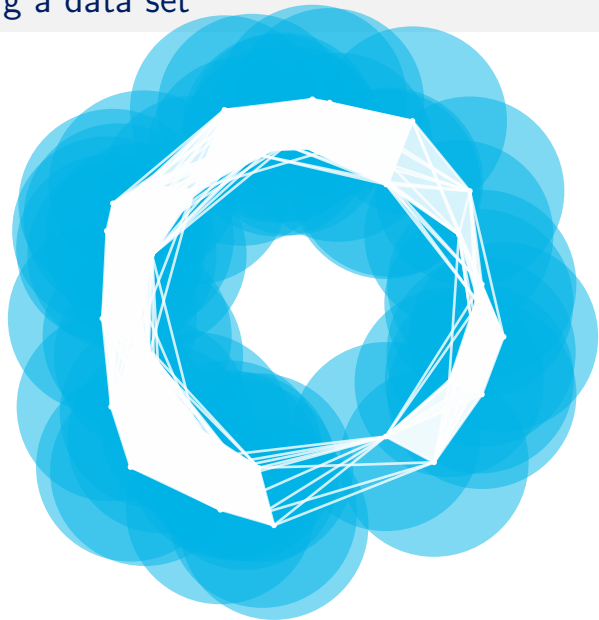
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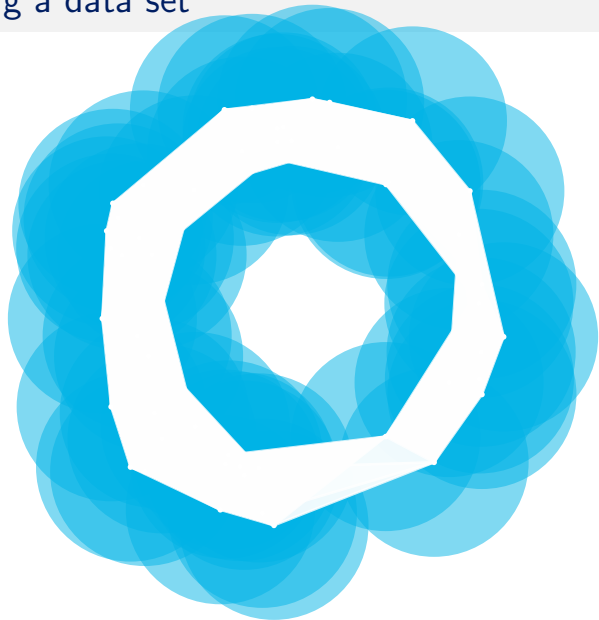
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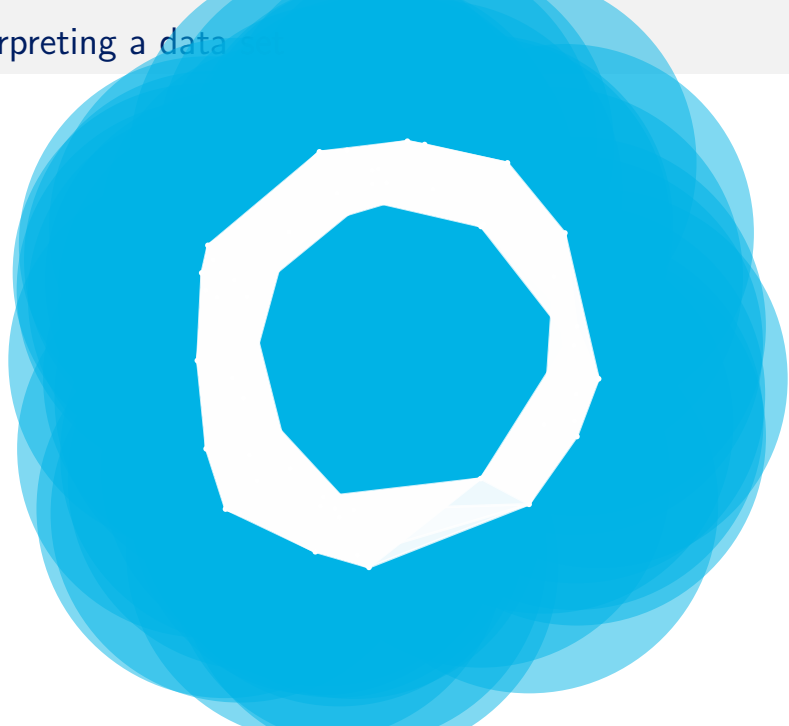
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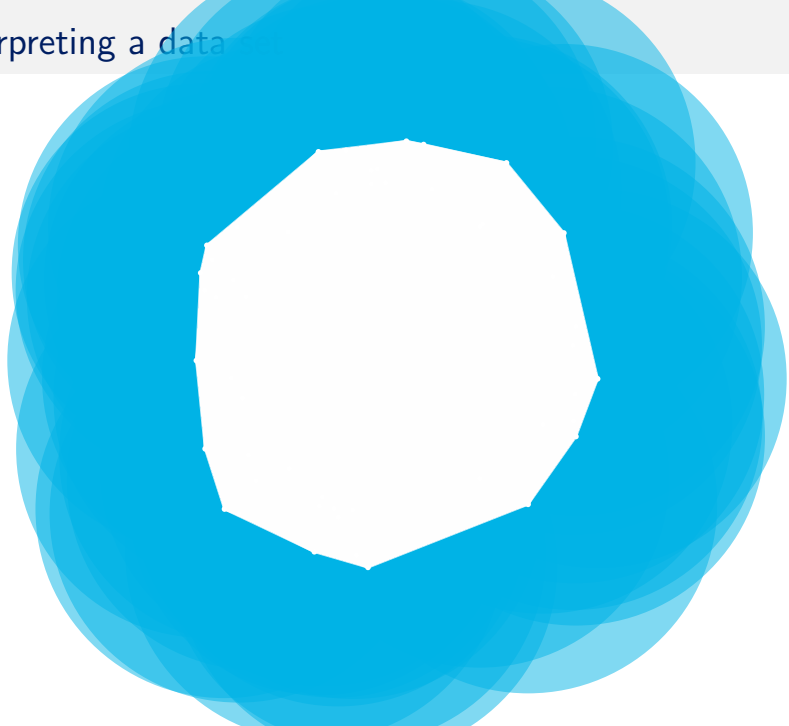
Interpreting a data set



Interpreting a data

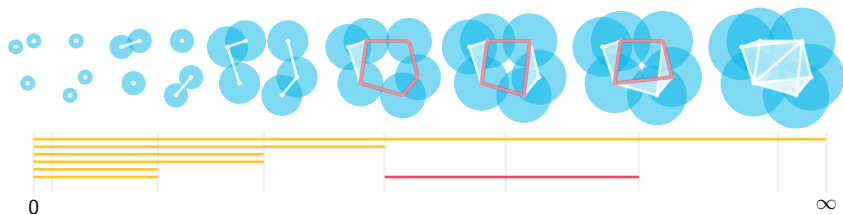


Interpreting a data



Ways we see and receive data

- ▶ Huge list, each item has several properties
 - ▶ Simplicial complex, Persistent homology, Barcode



- ▶ Streaming data that increases in size or changes over time
 - ▶ Paths and loops in configuration spaces

$$\gamma: [0, 1] \rightarrow \text{Conf}_n(X) := \{P \subseteq X : |P| = n\}$$

Methods and successes

- ▶ Clustering (1960s), Topological data analysis (2000s)
 - ▶ Work together to recognize large-scale patterns



different distances

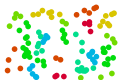


unusual geometry



significant topology

- ▶ Are all coordinates necessary?
- ▶ What is the simplest possible representation of the data?
 - ▶ The mapper algorithm



Thank you!

References

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