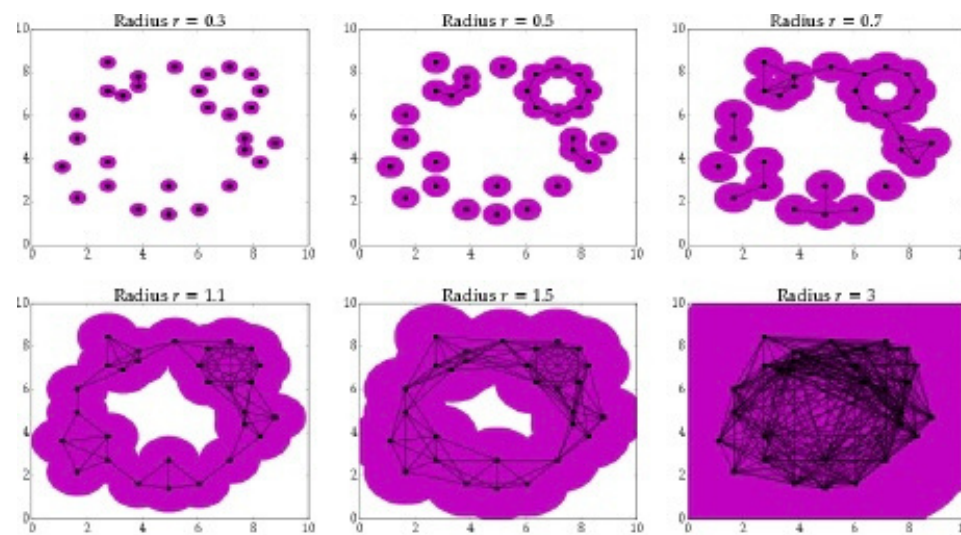


Topological Data Analysis

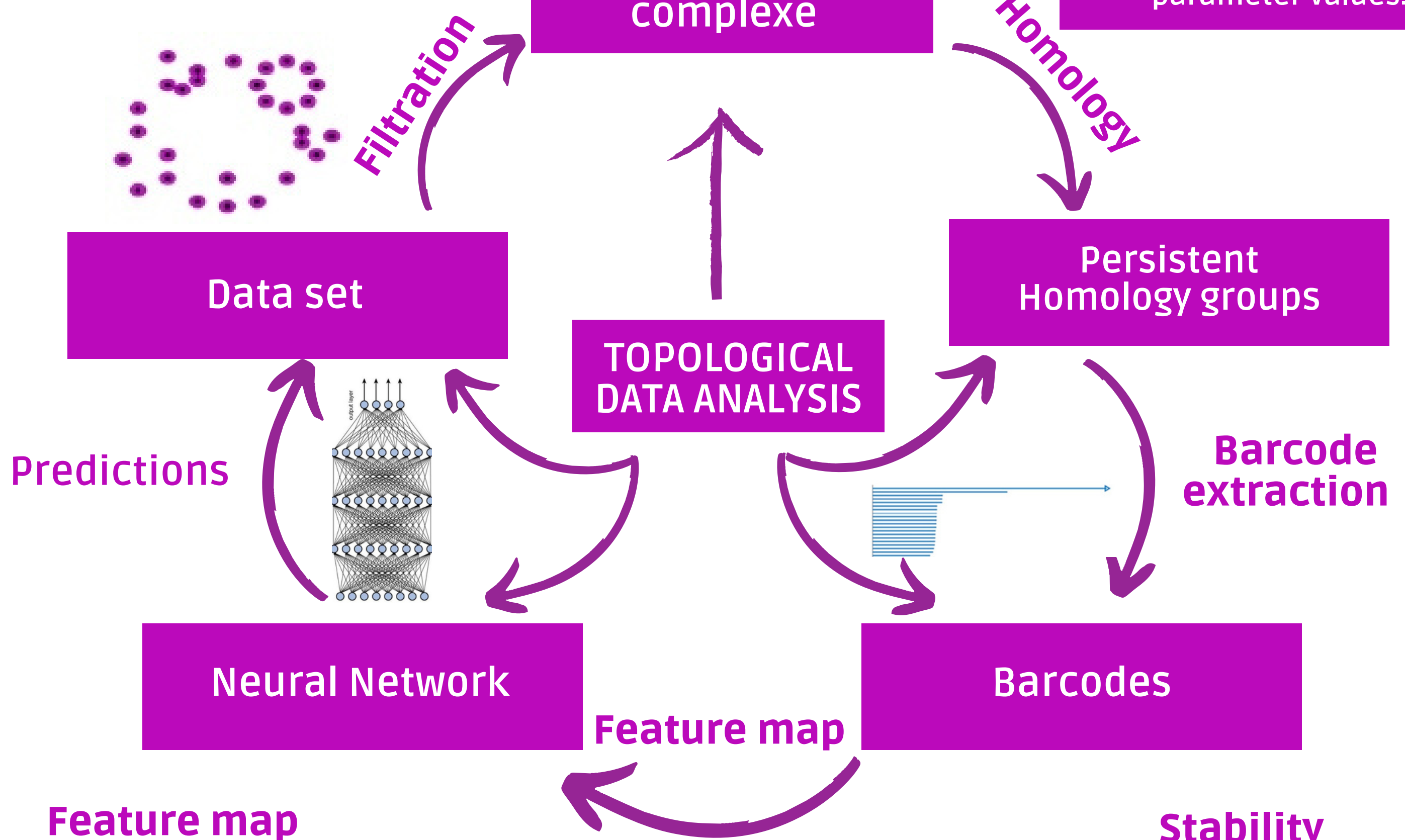
Data sets

In science, data is the information we gather from experiments, observations, or measurements. This data is then stored in research databases for future analysis and reference, allowing scientists to build upon existing knowledge and advance their understanding of the natural world.



Persistent Homology

Persistent homology offers a mathematical framework that allows us to systematically uncover and quantify enduring topological shapes or structures within data. This approach not only identifies these shapes but also provides a way to measure their persistence across different scales or parameter values.



Feature map

Feature maps in neural networks are generated by applying filters to input data, capturing important patterns like edges or textures. These maps are then used to make predictions through a series of transformations, typically involving pooling and fully connected layers, allowing neural networks to recognize complex patterns and make accurate predictions.

Applications

Topological Data Analysis (TDA) is applied in biology to understand protein structures and genomics, in neuroscience for analyzing brain connectivity networks, and in materials science to identify new materials with desired properties. It serves as a versatile mathematical tool, facilitating insights and solutions in these scientific fields by bridging the gap between mathematical theory and practical challenges.

Stability

The step that transforms collections of connected data sets into a coherent mathematical object known as a barcode holds immense significance. We can prove that minor perturbations in the data have a relatively limited impact on our mathematical representation.