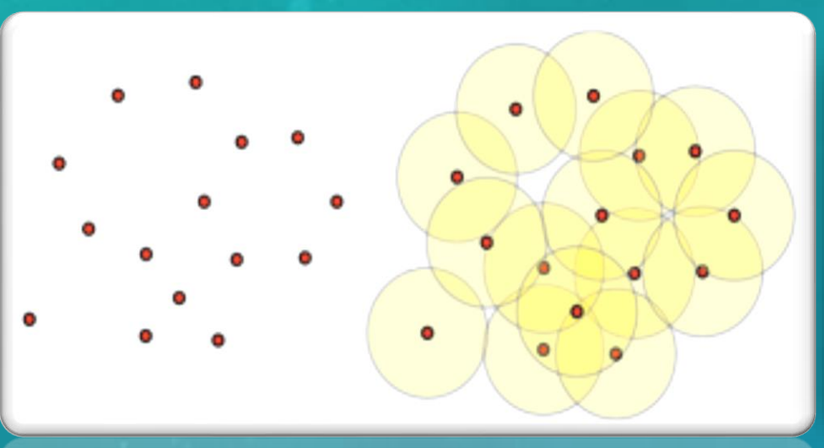
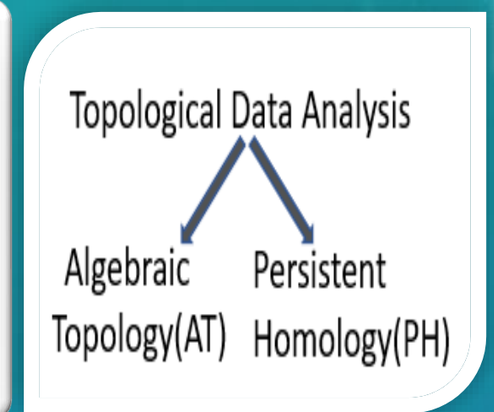
Statistics on the Space of Persistent Diagrams with Applications

> Data is a shape and shape is a data. We use Topological Data Analysis (TDA) to extract information from the data, but also TDA assumes that data have a shape.

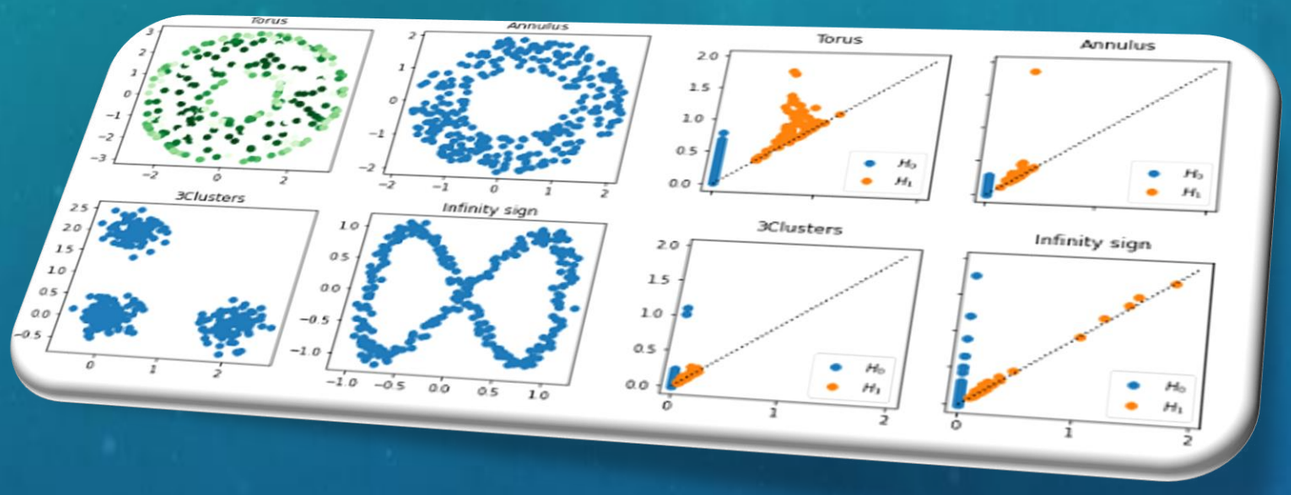




Software	Installation	Complex	Boundary matrix	Barcodes	Visualization	Data set size	Ease of Use
Javaplex	✓	✓	✓	✓	✓	Small	easy
Persus	✓	✓	✓	✓	✓	Small	easy
Dinoysus	– – –	✓	✓	✓	– – –	Medium	medium
DIPHA	– – –	✓	✓	✓	✓	Large	hard
GUDHI	– – –	✓	✓	✓	– – –	Large	hard
Ripser	– – –	✓	✓	✓	✓	Large	easy

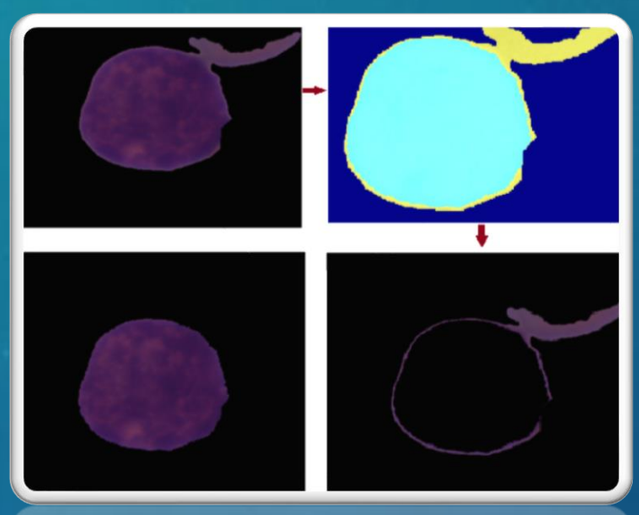
How AT and PH work in parallel?

> AT gives the Simplicial Complexes and PH computes them in the form of Persistent Diagrams or Barcodes.



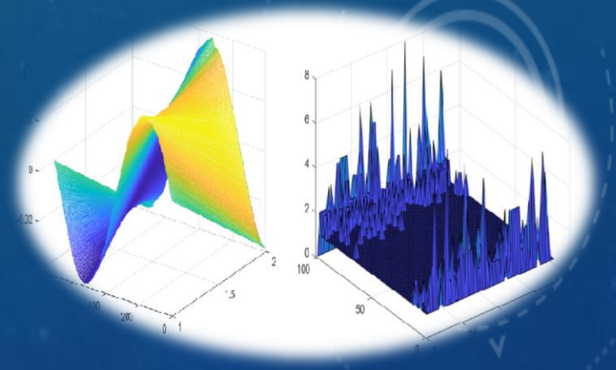
Application (Classification)

> Leukemia, a category of malignancies of the blood often develop in the Bone marrow and increases the lifespan of immature white blood cells (WBCs).

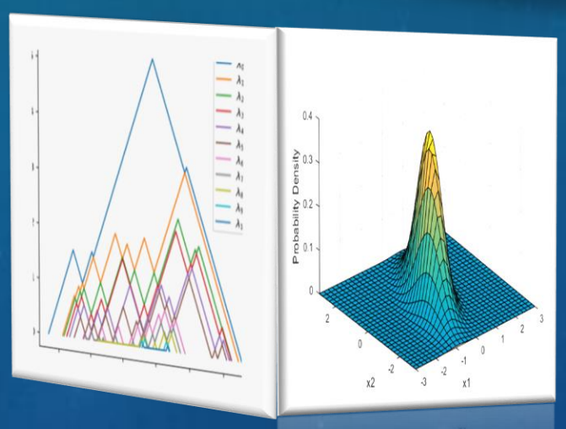


> The extraction of morphological and textural characteristics from specific cell areas, similar to the visual interpretation of a domain expert, improves the classifier's performance.

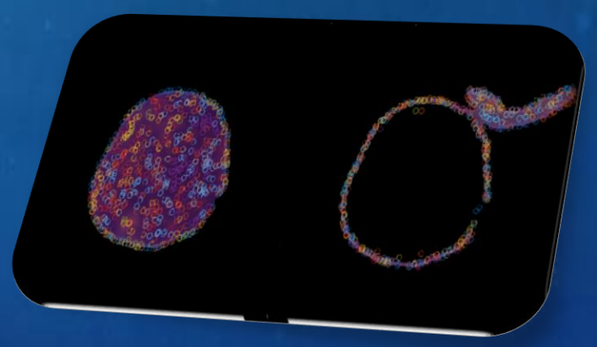
> SECT deals with boundary here are the Euler curves and boundary of a cell.



*** Persistent Landscape**



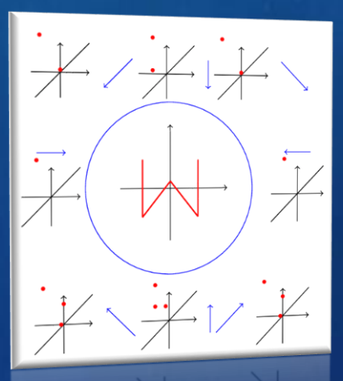
*** Riemannian Framework**



> Point Cloud (PC) used to classify the things, here is PC of Nucleus and Cytoplasm. Machine Learning techniques used for classifications.

*** Persistence Images**

*** Smooth Euler Charactertics Transform**



Results: Our model *F1* score is 78%, and we are still working on its betterment.

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