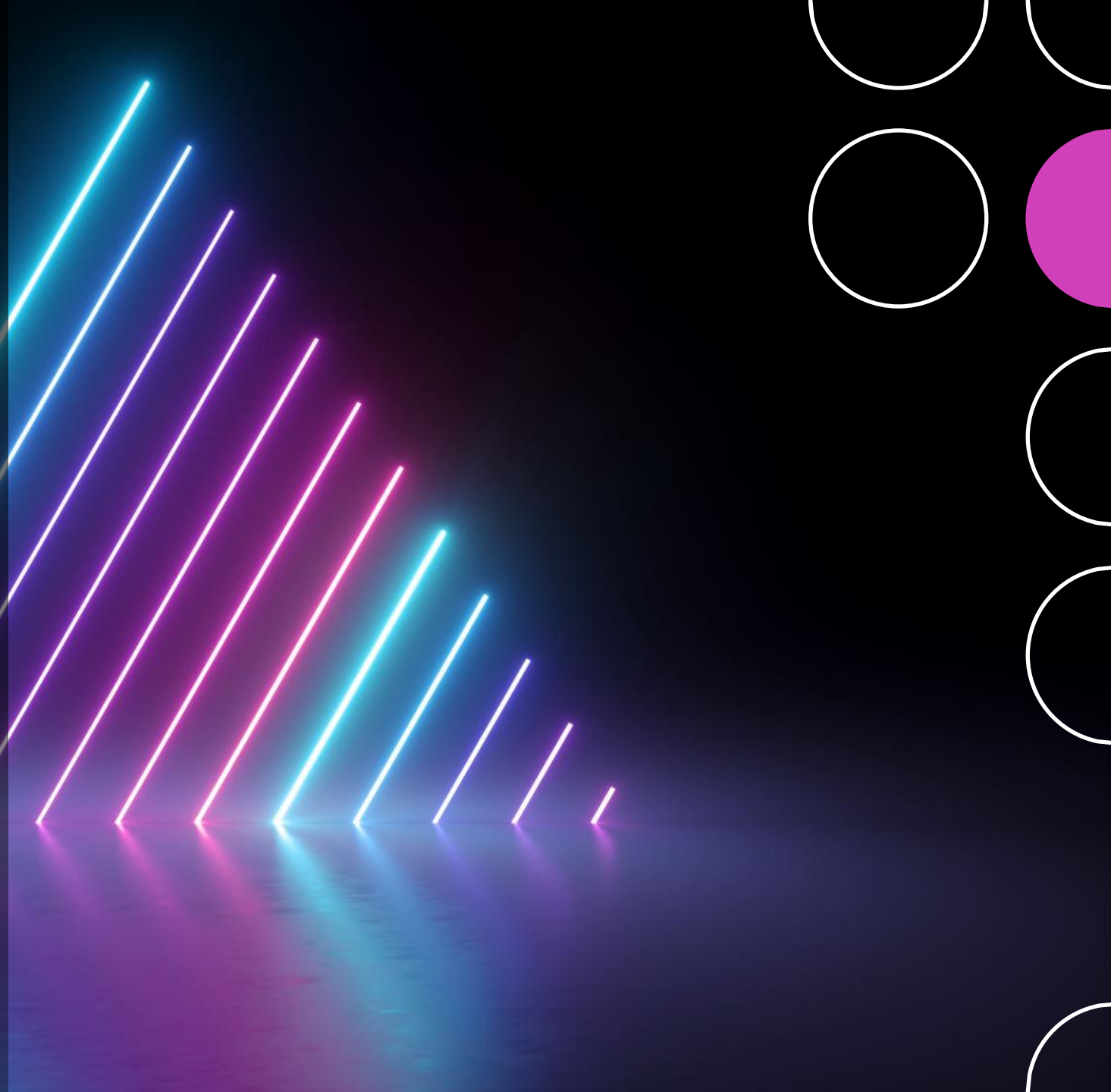
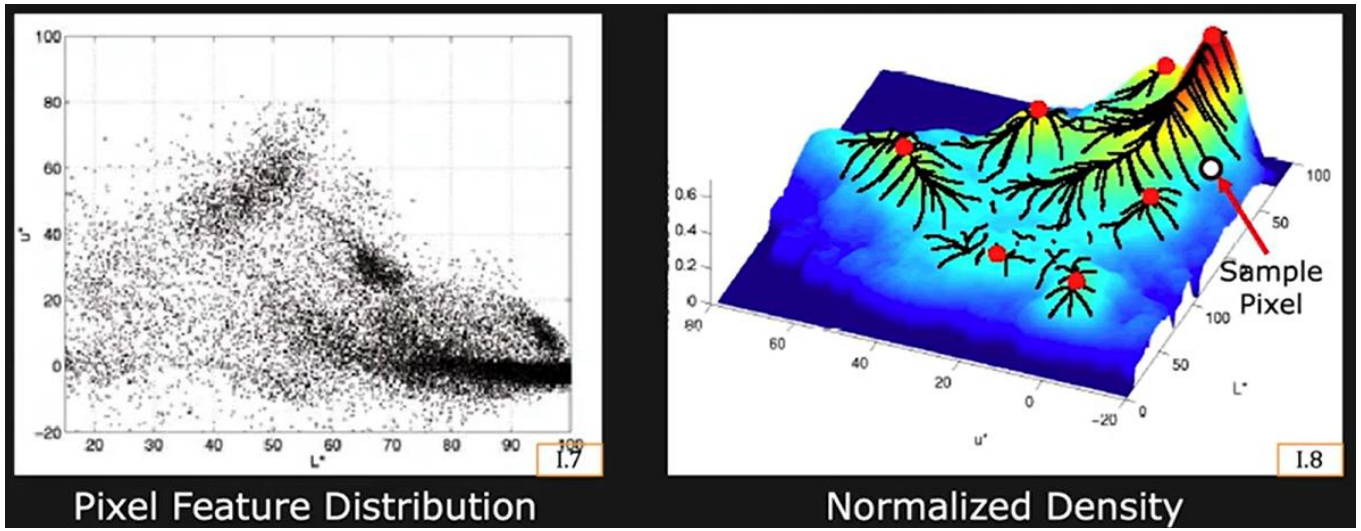
Segmentation as Clustering



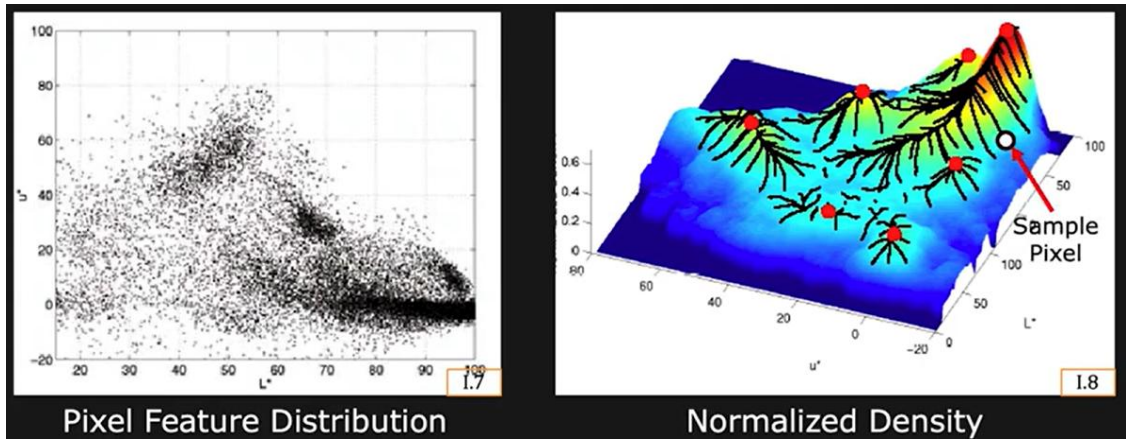
Means Shift Clustering

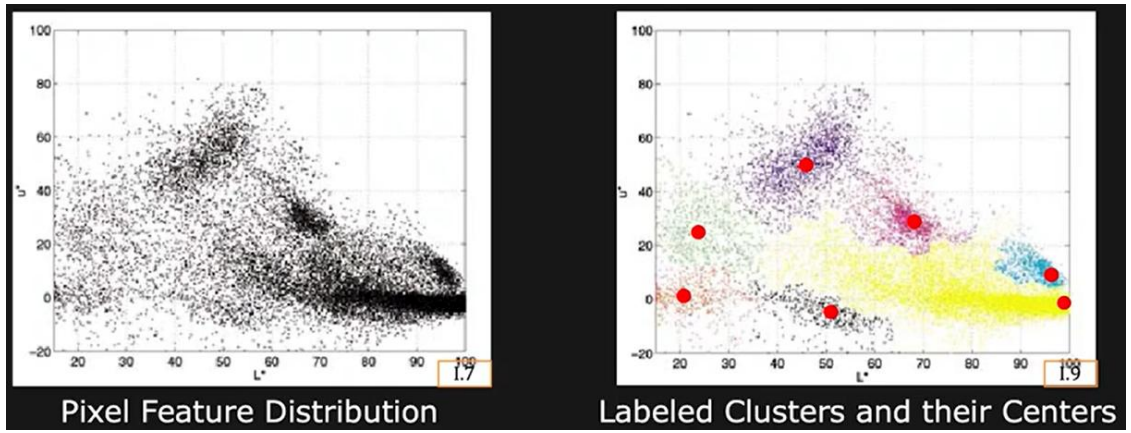
The concept of Mean Shift

- Each hill represents a cluster.
- Peak (mode) of the hill represents “centre” of the cluster.
- Each pixel climbs the steepest hill within its neighborhood.
- Pixel is assigned to the hill (cluster) it climbs.

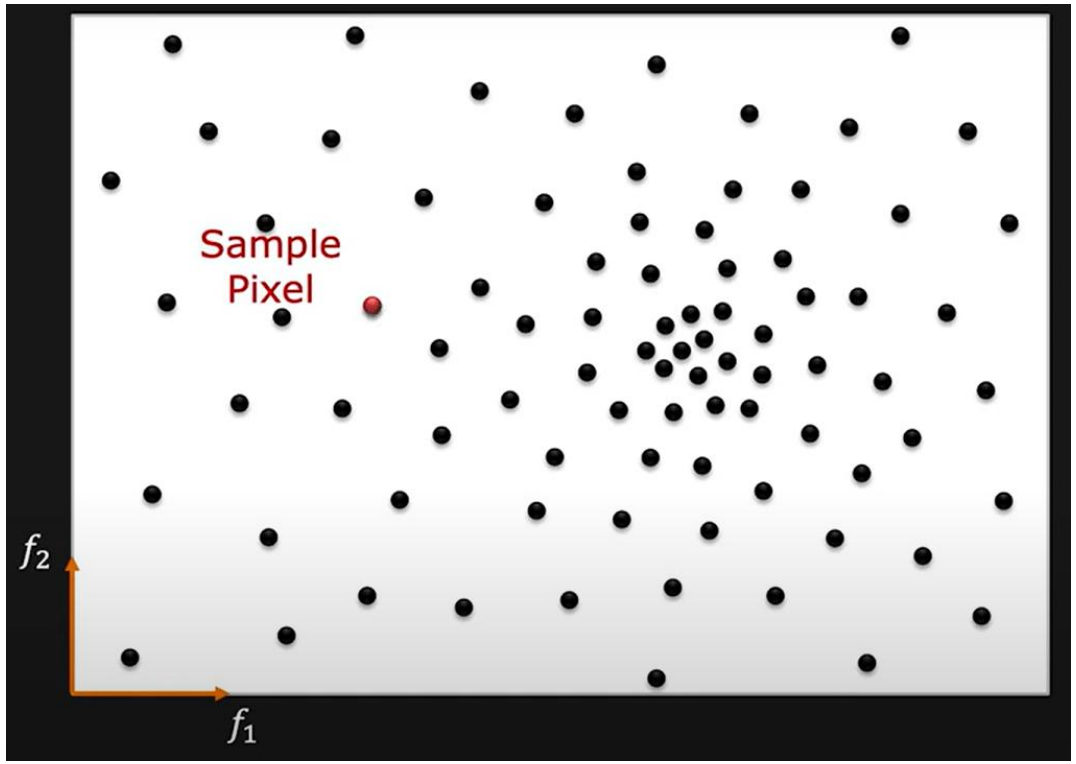


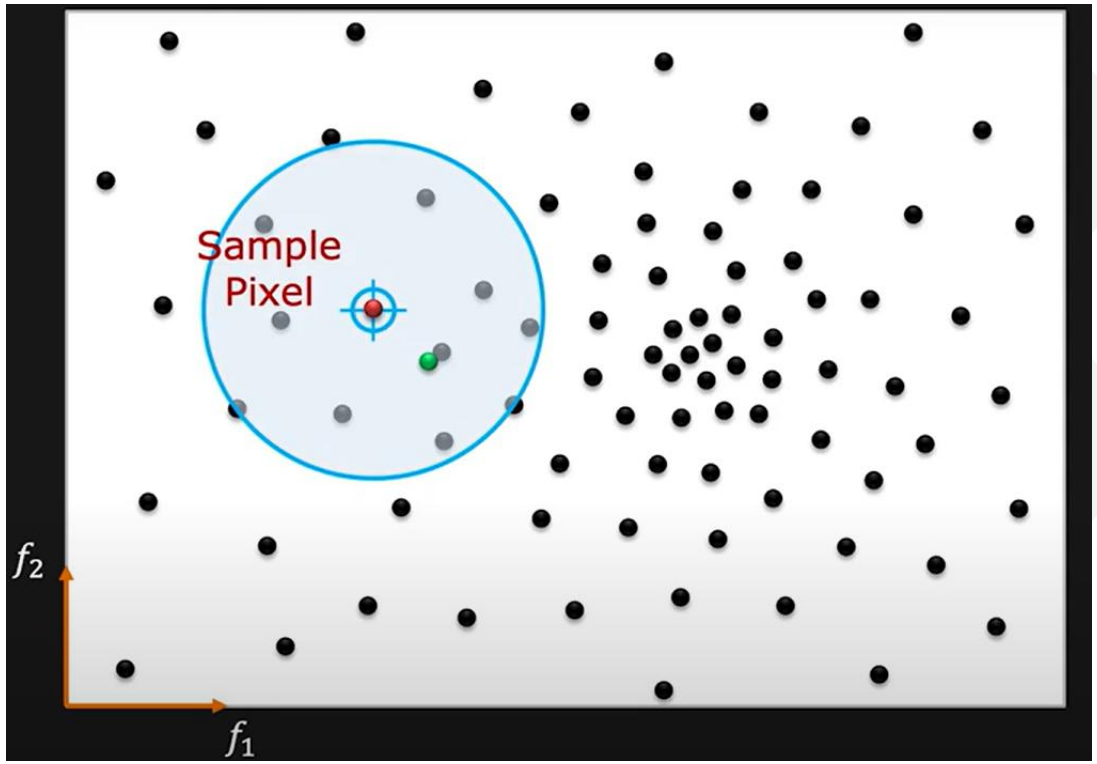
The concept of Mean Shift





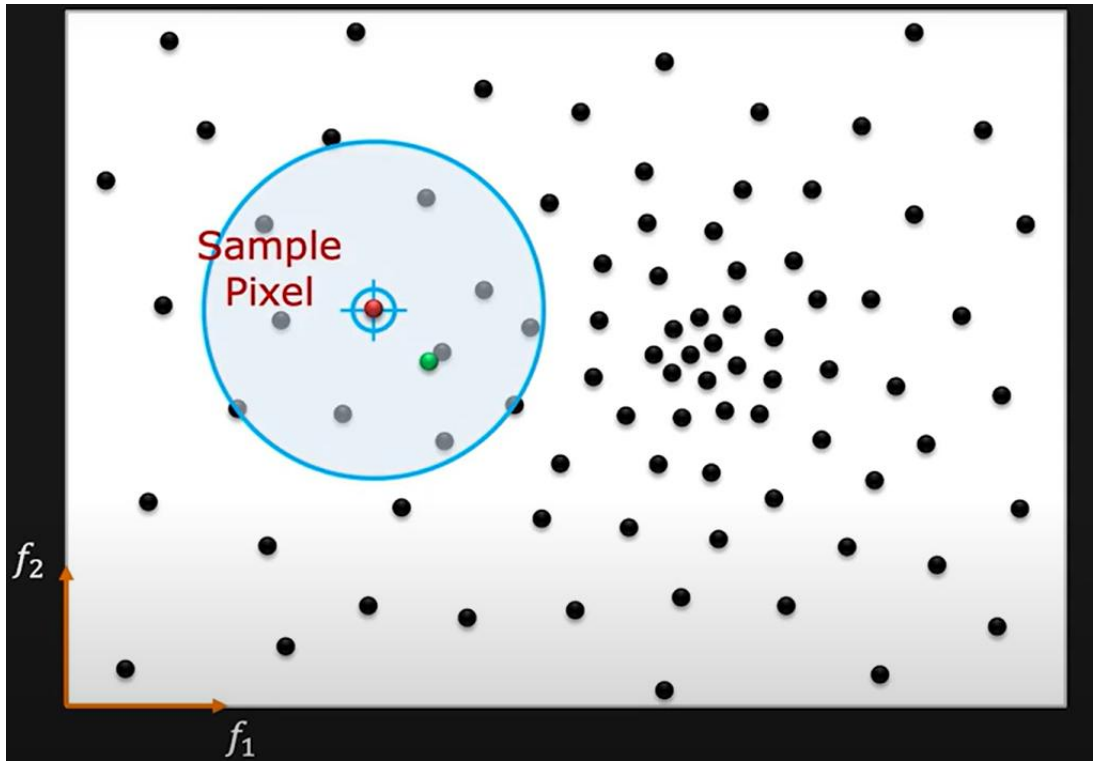
Hill climbing using Mean Shift

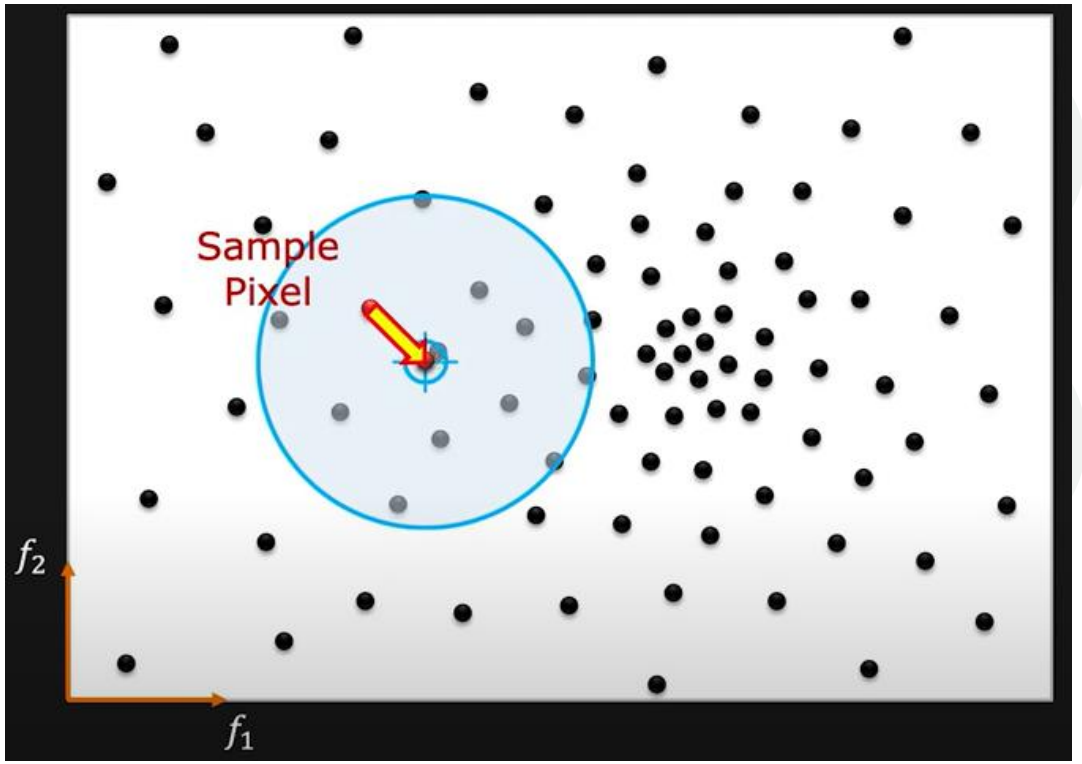




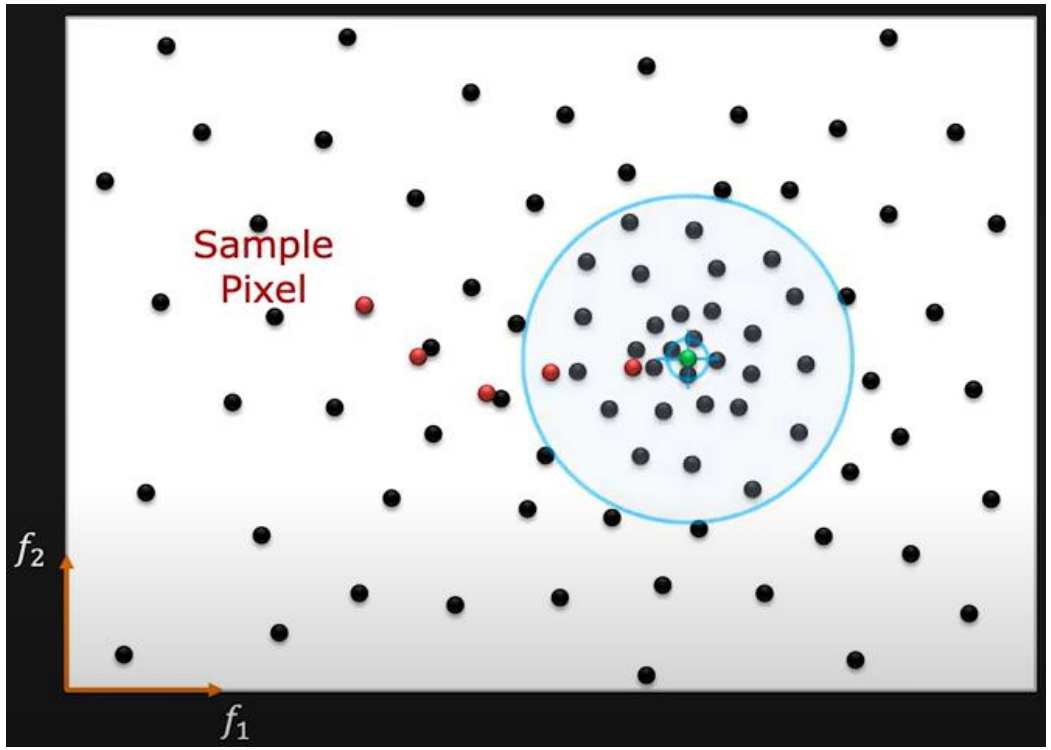
Compute Centroid within a window of size W.
Use simple Mean of Weighted Mean.

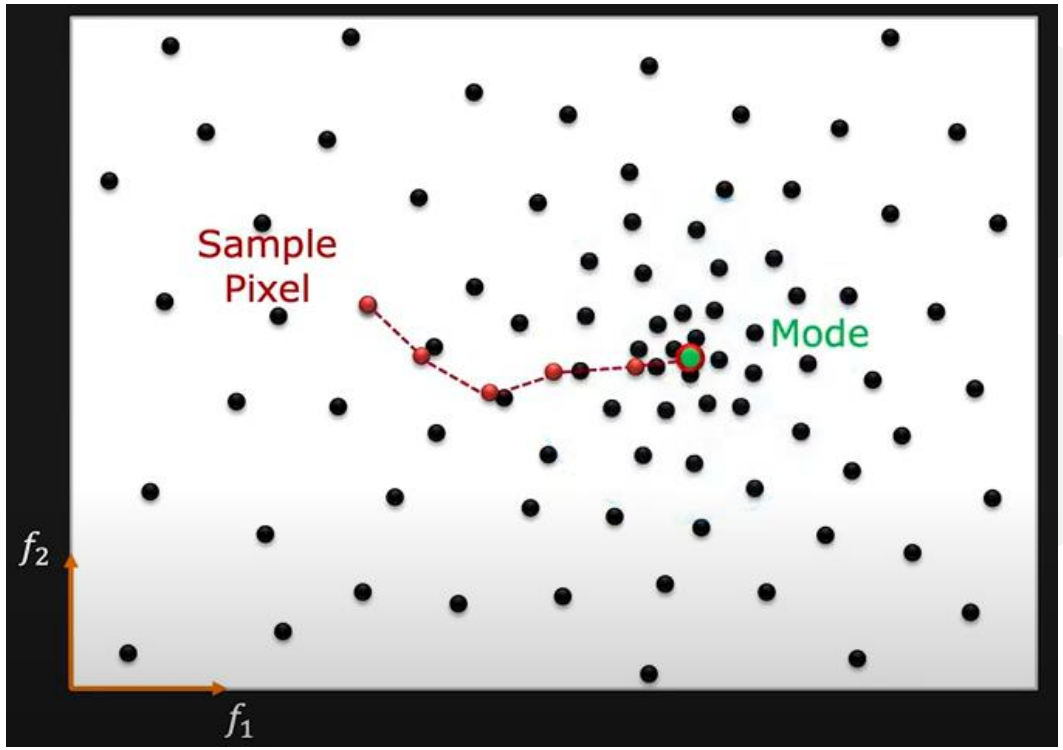
Hill climbing using Mean Shift





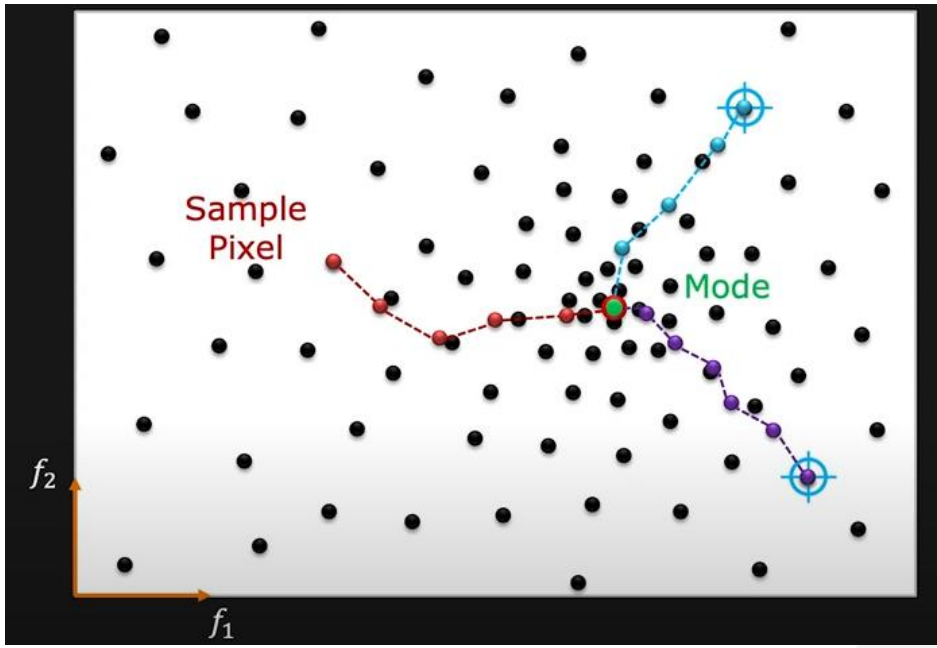
Hill climbing using Mean Shift





Hill climbing using Mean Shift

- Declare mode and assign it a cluster label
- Repeat for all pixels!
- Features that converge to same mode belong to the same cluster.



Mean Shift algorithm

Given: Distribution of N pixels in feature space.

Task: Find modes (clusters) of distribution.

Clustering:

1: Set $\mathbf{m}_i = \mathbf{f}_i$ as initial mean for each pixel i.

2: Repeat the following for each mean $\mathbf{m}_i$:

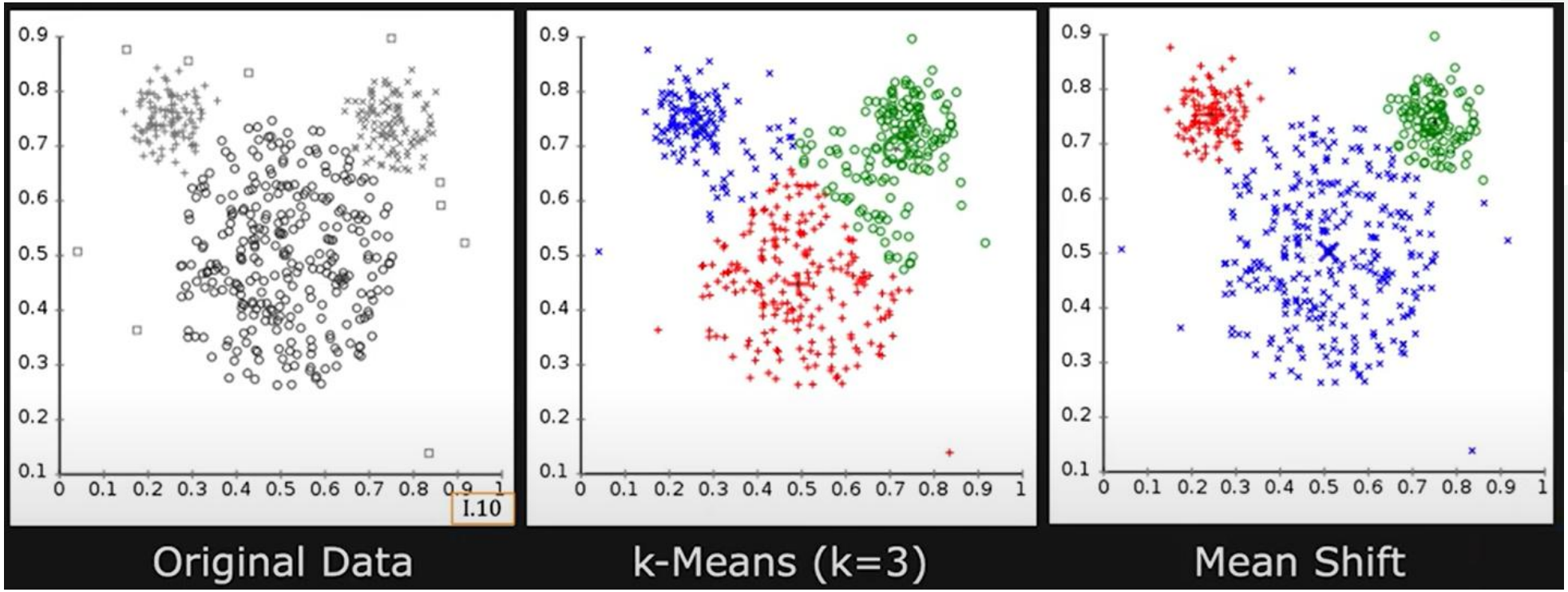
a: Place window of size W around $\mathbf{m}_i$.

b: Compute centroid $\mathbf{m}$ within the window. Set $\mathbf{m}_i = \mathbf{m}$.

c: Stop if shift in mean $\mathbf{m}_i$ is less than a threshold ε. $\mathbf{m}_i$ is the mode.

3: Label all pixels that have same mode as belonging to same cluster.

K-means v/s Mean Shift



Mean Shift: Remarks

- Simple but computationally expensive
- Finds arbitrary number of clusters
- No initialization required
- Robust to outliers
- Clustering depends on Window size W