Segmentation via Graph Cuts
– Prep Reading

Balakrishna Thiagarajan
Computer Science and Engineering
State University of New York at Buffalo
Segmentation

- **Segmentation** refers to the process of partitioning a digital image into multiple segments i.e. sets of pixels.

- Image segmentation is typically used to locate objects and boundaries like lines, curves, etc. in images.

- Important property of segmentation is that adjacent regions are significantly different with respect to the same characteristic(s)
Important Definitions in Graphs

Edge Connectivity:

- It is the minimum number of edges whose removal results in a disconnected graph. It is denoted by $k(G)$.

- For a graph $G$, if $k(G) = 1$ then $G$ is called an 1-connected graph.
Important Definitions in Graphs

Example:

GRAPH 1

GRAPH 2

The edge connectivity for the GRAPH 1 is 2.
The edge connectivity for the GRAPH 2 is 3.
Important Definitions in Graphs

Cut:

- A cut in a graph is a set of edges whose removal disconnects the graph.

- A minimum cut is a cut with a minimum number of edges. It is denoted by $S$.

- For a non-trivial graph $G$ iff $|S| = k(G)$. 
Important Definitions in Graphs

Example:

GRAPH 1

GRAPH 2

The min-cut for GRAPH 1 is across the vertex B or D.
The min-cut for GRAPH 2 is across the vertex A,B,C or D.
Important Definitions in Graphs

Distance $d(u,v)$:

- The distance $d(u,v)$ between vertices $u$ and $v$ in $G$ is the minimum length of a path joining $u$ and $v$.
- The length of a path is the number of edges in it.
Important Definitions in Graphs

Diameter of a connected graph:

- It is the longest distance between any two vertices in $G$. It is denoted by $\text{diam}(G)$.

Degree of vertex:

- It is the number of edges incident with the vertex $v$. It is denoted by $\text{deg}(v)$.
- The minimum degree of a vertex in $G$ is denoted by $\delta(G)$. 

Important Definitions in Graphs

Example:

\[
d(A,D) = 1 \quad d(B,D) = 2 \quad d(A,E) = 2
\]

Diameter of the above graph = 2

\[
deg(A) = 3 \quad deg(B) = 2 \quad deg(E) = 1
\]

Minimum degree of a vertex in G = 1
Thank You!!