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**Algorithm 1** Spectral Bridges Clustering

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SpectralBridges( $data, k, p$ )  $data$ : input dataset,  $k$ : number of clusters,  $p$ : number of Voronoi regions  
 $centroids \leftarrow KMeans(data, p)$  Initial centroids using k-means  
 $voronoiRegions \leftarrow Subdivide(data, centroids)$  Subdivide data into Voronoi regions  
 $graph \leftarrow CreateGraph(voronoiRegions)$  Assess connectivity between regions  
 $clusters \leftarrow WardLinkage(graph, k)$  Cluster using Ward linkage-inspired approach  
 $clusters \leftarrow KMeans(data, p)$  Initialize  $p$  centroids randomly  
Assign each point to the nearest centroid  
Update centroids based on assignments  
centroids do not change  
 $centroids \leftarrow Subdivide(data, centroids)$   
 $voronoiRegions \leftarrow \{\}$  each point  $x$  in  $data$  Find the nearest centroid for  $x$   
Assign  $x$  to the corresponding Voronoi region  
 $voronoiRegions \leftarrow CreateGraph(voronoiRegions)$   
 $graph \leftarrow$  empty graph each pair of regions  $(R_i, R_j)$  in  $voronoiRegions$   
Calculate connectivity measure between  $R_i$  and  $R_j$   
Add edge between  $R_i$  and  $R_j$  in  $graph$  with weight based on connectivity  
 $graph \leftarrow WardLinkage(graph, k)$   
 $clusters \leftarrow$  Initialize each region as a separate cluster  
Find the pair of clusters with the smallest merging cost  
Merge the selected pair of clusters  
number of clusters equals  $k$   $clusters$

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