Joint Semantic-Instance Segmentation of 3D Point Clouds: Instance Separation and Semantic Fusion
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• Introduction:
  3D Semantic and Instance Segmentation Input: 3D point clouds. Output: instance labels and semantic labels for each point.
  Joint 3D Semantic-Instance Segmentation, points with different semantic labels must belong to different instances, points within the same instance must share the same semantics.

• The overall framework:
  Two task branches: In Fig. 2 A point cloud encoder (e.g. PointNet) used to extract feature F. Then one branch for semantic seg. (orange) and the other for instance seg. (green).
  Two modules set up cooperation. Instance Separation Module(purple) estimates object centroid O, which concat with S to create semantic-aware instance feature. The Semantic Fusion Module(blue) uses instance embedding to produce attention map and get more instance consistent semantic feature.

• Two interaction modules
  Instance Separation. Semantic feature can help separate different semantic instances. However, the same semantics may contain different instances. So we further supplement the semantic feature with instance-position specific information.
  Semantic Fusion. Points within the same instance must have the same semantics. We produce an attention map between each pair of points in the instance embedding space, and then used to aggregate the semantic information in the semantic feature space.

• Experiments:
  Compare with other methods.

• Ablation studies on two modules.

Fig. 1: Joint two tasks with two interaction modules.

Fig. 2: The overall network.

Fig. 3: Two interaction modules: instance separation and semantic fusion

Fig. 4: The semantic and instance seg. results. compare with the ASIS method.

Fig. 5: Visualization of the estimates object centroid O (left) and the attention maps (left)