Terms and functions

- **VisiblePoints** : Number of point visible from all the selected OCs when rendered from a top view.
- **VisibleInliers** : Number of **VisiblePoints point that has and inlier in the point cloud.
- **UniqueVisibleInliers**: Number Visible Inliers that does not share indexes in the Point Cloud. Only if more than two OCs are colliding is .
- **PointCloudPoints**: Number of points in the pointcloud(the one captured by scape).
- **CollisionDepth:** The maximum penetration depth for a OC in a given hypothesis.
- **OCScore**: Score for a given OC, in the scape dataset this is given.
- **PenalizedVisibleInliers**:

$$\text{PenalizedVisibleInliers} = \sum_{SelectedOC(SOC)} \text{VisiblePoints}_{\text{SOC}} \cdot \sigma(\text{CollisionDepth}_{\text{SOC}}) \tag{1}$$

$$\sigma(x) = \frac{1}{1 + e^{-g*(x-c)}} \tag{2}$$

  - ***g***: sigmoid growth rate, usually from 5-10, ***c***: sigmoid center, usually around 2-5 mm
- ***InliersThreshold***(0-1): Theshold to determine what the ration between **VisiblePoints** and **PenalizedVisibleInliers** needs to be for cost to increase. Used differently in GEIC than in GEICS and GEUICS.
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Genetic Evaluators(GEs)

Genetic Evaluator Inlier Collision(GEIC)

$$\text{cost} = \text{VisiblePoints} - \frac{\text{PenalizedVisibleInliers}}{\text{InliersThreshold}} \tag{3}$$

Genetic Evaluator Inlier Collision Scaled(GEICS)

$$\text{cost} = 1 - \frac{\text{VisibleInliers}}{\text{PointCloudPoints} + \max(\text{InlierThreshold} * \text{VisiblePoints} - \text{PenalizedVisibleInliers}, 0)} \tag{4}$$

Genetic Evaluator Unique Inlier Collision Scaled(GEUICS)

$$\text{cost} = 1 - \frac{\text{UniqueVisibleInliers}}{\text{PointCloudPoints} + \max(\text{InlierThreshold} * \text{VisiblePoints} - \text{PenalizedVisibleInliers}, 0)} \tag{5}$$

Genetic Evaluator Score Collision(GESC)

$$cost = -\sum_{Selected OC(SOC)} \text{OCScore}_{\text{SOC}} * (1 - 2 * \sigma(\text{CollisionDepth}_{\text{SOC}})) \tag{6}$$