RANSAC - Random Sampling and Consensus.

ϵ : prob that a given pt is outlier

Parameters

* Minimal set of samples per trial = n or (s)
* No of trials : N
* distance threshold : δ — to be accepted as inlier
* minimum value of size of inlier set : M for it to be acceptable
* Probability that atleast one of the random samples of 'n' points is free from outliers : $p\ (= 0.99)$

prob that pt is inlier : $(1-\epsilon)$

Prob all pts inliers in 'n' pt sample = $(1-\epsilon)^n$

Prob that atleast 1 pt inlier in 'n' pt sample = $1 - (1-\epsilon)^n$

Prob that N samples of 'n' pts contain no inlier

$$= 1 - \left[1 - (1-\epsilon)^n\right]^N$$

Prob that atleast one of the N trials is free from outliers = P

= 1 − Prob that none of the N trials are free from outliers

Prob that none of 'N' trials are free from outliers =

i.e. Prob that all of the N trials contain atleast one outlier sample

= (Prob of having atleast one outlier in 'n' sample)^N

Prob of having atleast 1 outlier in 'n' sample pts =

1 − Prob of having no outliers in 'n' sample pts

↓

= Prob of all 'n' pts being inliers

= $(1-\epsilon)^n$

∴ Prob that atleast one of the N trials is free from outlier

$P = 1 - [1-(1-\epsilon)^n]^N \quad \Rightarrow \quad N = \frac{\ln(1-P)}{\ln[1-(1-\epsilon)^n]}$

$M = n_{total} \times (1 - \epsilon)$.

no_iter = 0 pts to consider = [ ]

M_best = 0

while no_iter < N

- sample 'n' points (x x') correspondences
- compute 'H' with n pts
- Find $Hx = \tilde{x}$
- compare $\tilde{x}$ & x' & see if dist $(\tilde{x}\ x') < \delta$
  if less consider as inlier
- count no of inlier pts = no_inlier
- if no_inlier > M
  if M_best < no of inlier
  M_best = no of inliers
  pts to consider append pts + inliers
- no of iter + = 1

Recompute homography H with pts_to_consider

RANSAC - inlier, outlier plot.

Adaptive

* Since we usually dont know what ϵ is, the no of samples N should be computed adaptively

$N = \infty$, no_of_iter = 0

While $N > no\_of\_iter$:

- Choose a sample & count no of inliers
- Set $\epsilon = 1 - (\text{no of inliers}) / (\text{tot no of pts})$
- Set Compute N from ϵ & $p = 0.99$
- no_of_iter += 1

Terminate