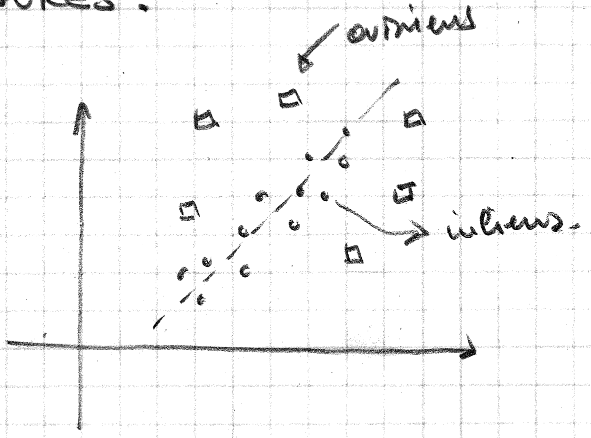
# CLASE 6: RANSAC and ERROR MEASURES.




## * RANSAC:

Problem Definition

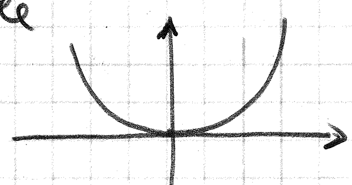
$f(x) = y$ ← model $x \to y$

Empirical Data i.e. $(\tilde{x}_i, \tilde{y}_i)$ ← this input data may be (a) a point that fits the model corrupted with gaussian noise

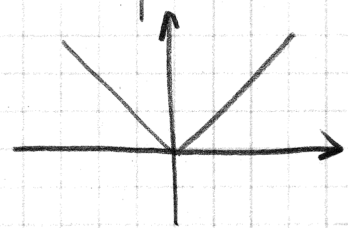
$\tilde{x}_i = x_i + n_i$, $\tilde{y}_i = y_i + n_i$ / $f(x_i) = y_i$ ; or (b) it may be an outlier

Error measurement $e(\tilde{x}_i, \tilde{y}_i)$, for example

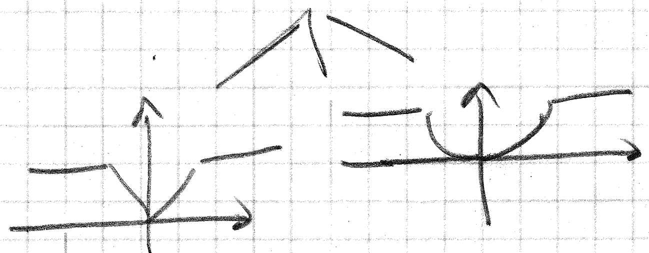
$\| \; \|_2^2 \to e(x_i, y_i) = \| f(x_i) - y_i \|_2^2$



$\| \; \|_1 \to e(x_i, y_i) = | f(x_i) - y_i |$



? more sophisticated penalty functions



ETC.

) Ransac algorithm:

① Select a random set of points ($n$ = min number that allows us to estimate $f$)

$(\tilde{x}_1, \tilde{y}_1) \ldots (\tilde{x}_m, \tilde{y}_m) \to (\tilde{x}_{p_1}, \tilde{y}_{p_1}), \ldots, (\tilde{x}_{p_n}, \tilde{y}_{p_n})$ $\quad p_i \in \{1, \ldots, m\}$

② Using this point fit the model:

$$f^* = \underset{f \in \mathcal{F}}{\operatorname{argmin}} \; e(f(\tilde{x}_{p_k}), \tilde{y}_{p_k})$$

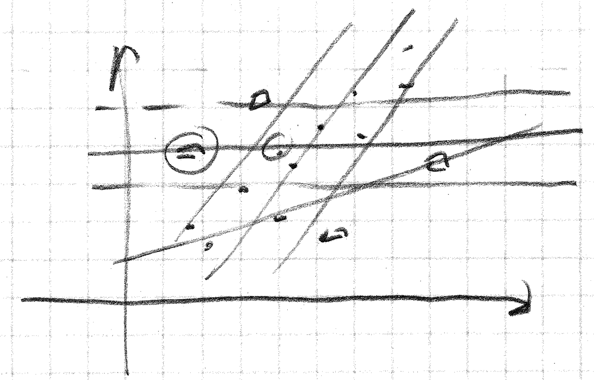
$\mathcal{F}$ → space of models.

...) measure how many of the remaining points fits the model

...) Repeat this steps N times and keep the model with more inliers.

Ex:

...u



...amography: $(x_1, x_1') - (x_8, x_8') \longrightarrow H \longrightarrow \underline{x_k H \times x_k' < th?}$

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Error MEASURE: (For example for H estimation)

algebraic error: $\underbrace{x H \times x'}_{\text{easy}}$ "(=0)" (for example if we multiply by an const.)

easy ← is numerically what we aim to minimize.

problem: geometrically meanless

advantage: numerically easy to implent and minimize

gold standard: $\epsilon(H, \hat{x}) = d(x, \hat{x})^2 + d(x', H\hat{x})^2$

problem: difficult to minimize, and we need to estimate $\hat{x}_i$

advantage: geometrically meaningfull

Sampson error: taylor expansion around $\hat{x}$ of gold standard error (see CLASE 5 - add material)

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