Measurement models

- Which of the following statement are true in a filtering context?

Yellow — The measurement model describes the statistics of a sensor observation as a function of the state vector.

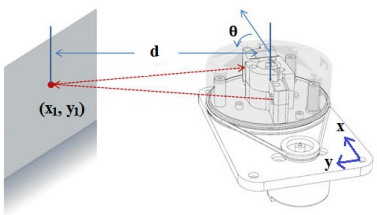
Orange — Using the measurement model, it is often possible to simulate (sample) *sensor observations* from a know *state*.

Green — Using the measurement model, it is often possible to simulate (sample) *states* using a know *observation*.

Pink — The measurement model describes the distribution of the state from a given sensor observation.

There are many sensors that measure bearing, θ, and/or distance, d, to objects. This lidar is one example.

If the rotational axis of the lidar is in (x_0, y_0) and it is aligned as in the picture, what is a reasonable measurement model for the bearing, θ, to an object located in (x_1, y_1) which is being tracked by your filter?



- Which of these models are reasonable measurement models for z_k? Note: z_k is a noisy observation of θ.

Yellow $z_k = \text{atan}((y_1 - y_0)/(x_1 - x_0) + r_\theta,\ r_\theta \sim \mathcal{N}(0, R_\theta)$

Orange $z_k = acos((x_1 - x_0)/d) + r_\theta,\ r_\theta \sim \mathcal{N}(0, R_\theta)$

d is not a state

Green $p(z_k|x_1, y_1) = \mathcal{N}(z_k; atan((y_1 - y_0)/(x_1 - x_0)), R_\theta)$

Pink $z_k = \sqrt{(x_1 - x_0)^2 + (y_1 - y_0)^2} + r_\theta,\ r_\theta \sim \mathcal{N}(0, R_\theta)$