Ben: develop method to produce reasonable transition probabilities for state-action pairs

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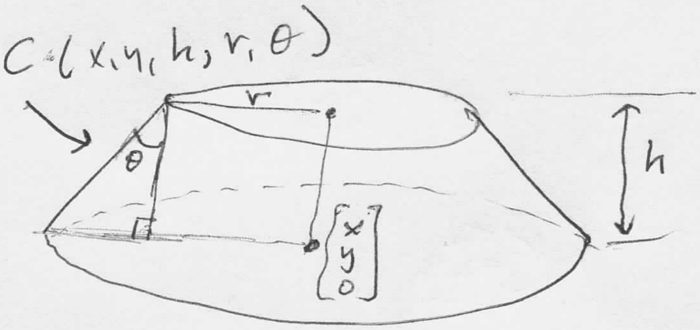
* states: assume N x R x W 8 states
* actions: assume existing plans
  - P_CORRECT_HEADING
  - P_CORRECT_SPEED
  - P_FOLLOW_LANE
  - P_GO_TO_LANE

environment model



* rain
  - center: $[x, y, 0]^T$
  - height: h
  - radius: r at $[x, y, h]^T$
  - theta: θ slope of cone (truncated)

$$\text{intensity}(x, y, z, t) = \mathcal{N}\left(C(x, y, h, r, \theta), \sigma_r^2\right)$$

$$\text{rain}(x, y, z, t) = \max_{C \in \text{centers}} \text{intensity}(x, y, z, t)$$

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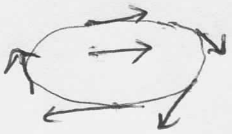
* wind

center: $[x_w, y_w, 0]^T$

height: h

direction: cw, ccw

mag_w : m_w



cw

or

ccw

Mag = function of r + z : f(r,z)

where $r = \left| \begin{bmatrix} x \\ y \end{bmatrix} - \begin{bmatrix} x_w \\ y_w \end{bmatrix} \right|$

z is height (altitude)

f falls off as r grows

$\overline{dir}$ is tangent to circle of radius r at x, y location and is cross product of $\begin{bmatrix} x \\ y \\ z \end{bmatrix} - \begin{bmatrix} x_w \\ y_w \\ z \end{bmatrix}$ and $\begin{bmatrix} 0 \\ 0 \\ h \end{bmatrix}$ cw

$$cw = \left(\begin{bmatrix} x - x_w \\ y - y_w \\ 0 \end{bmatrix} \times \begin{bmatrix} 0 \\ 0 \\ h \end{bmatrix} \right)$$

$$ccw = \begin{bmatrix} 0 \\ 0 \\ h \end{bmatrix} \times \begin{bmatrix} x - x_w \\ y - y_w \\ 0 \end{bmatrix}$$

$$wind(x, y, z, t) = N\left(\sum_i w_i(x, y, z, t), \Sigma_w\right)$$

multi-variate normal distribution

To Do

* implement rain & wind models
* run simulation
  + record (S, A, S') results
  + compute transition probabilities

Michael: develop methods to produce reasonable rewards based on robust set of plans

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currently: rewards are set qualitatively

need: analyze fundamental basis for rewards

- should combine goodness of state (e.g., Nominal is better than ¬Nominal) with cost of action

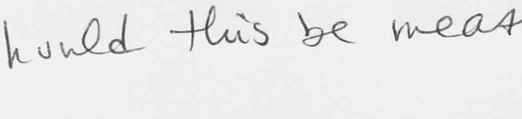
* need reasonable values for costs of actions

how should this be measured?

- may need to rethink problem or at least analyze alternatives carefully:

  + current N×R×W + related plans

  + some version of moving along lane segment



e.g., cost as:

$\propto w_1 d_3 + \left(1 - \frac{d_1}{d_1 + d_2}\right) w_2$

weights w_1 + w_2