Scene-aware and Social-aware Motion Prediction for Autonomous Driving

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Agenda

1. Method
   - Integration Model
2. Template

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Ballistic Integration Model

Distance and Velocity Equations:

$$s(k+1) = s(k) + dt \cdot v(k) + \frac{dt^2}{2} a(k) \qquad v(k+1) = v(k) + dt \cdot a(k)$$

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Acceleration Equations:

$$a(k) = \frac{2}{dt^2}\Big(s(k+1) - s(k) - dt \cdot v(k)\Big) \qquad a(k) = \frac{1}{dt}\Big(v(k+1) - v(k)\Big)$$

Ballistic Integration Model

Distance and Velocity Equations:

$$s(k+1) = s(k) + dt \cdot v(k) + \frac{dt^2}{2} a(k) \tag{1}$$

$$v(k+1) = v(k) + dt \cdot a(k) \tag{2}$$

Ballistic Integration Model

Distance and Velocity Equations:

$$s(k+1) = s(k) + dt \cdot v(k) + \frac{dt^2}{2} a(k) \tag{1}$$

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Acceleration Equations:

$$a(k) = \frac{2}{dt^2} \Big(s(k+1) - s(k) - dt \cdot v(k) \Big) \tag{3}$$

$$a(k) = \frac{1}{dt} \Big(v(k+1) - v(k) \Big) \tag{4}$$

Our Integration Model

Distance and Velocity Equations:

$$s(t+1) = s(t) + dt \cdot v(t) + c_3 a(t) + c_4 a(t-1) \tag{5}$$

$$v(t+1) = v(t) + c_1 a(t) + c_2 a(t-1) \tag{6}$$

Our Integration Model

Distance and Velocity Equations:

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$$v(t+1) = v(t) + c_1 a(t) + c_2 a(t-1) \tag{6}$$

Acceleration Equations:

$$a(k) = -\overline{c}_1 a(k-1) + \overline{c}_2 \big(s(k+1) - s(k) - dt \cdot v(k)\big) \tag{7}$$
$$a(k) = -\overline{c}_3 a(k-1) + \overline{c}_4 \big(v(k+1) - v(k)\big) \tag{8}$$

Our Integration Model

Model in matrix form:

$$\begin{bmatrix} a(k) \\ a(k) \end{bmatrix} = \begin{bmatrix} -a(k-1) & s(k+1) - s(k) - dt \cdot v(k) & 0 & 0 \\ 0 & 0 & -a(k-1) & v(k+1) - v(k) \end{bmatrix} \begin{bmatrix} \overline{c}_1 \\ \overline{c}_2 \\ \overline{c}_3 \\ \overline{c}_4 \end{bmatrix}$$

Our Integration Model

Model in matrix form:

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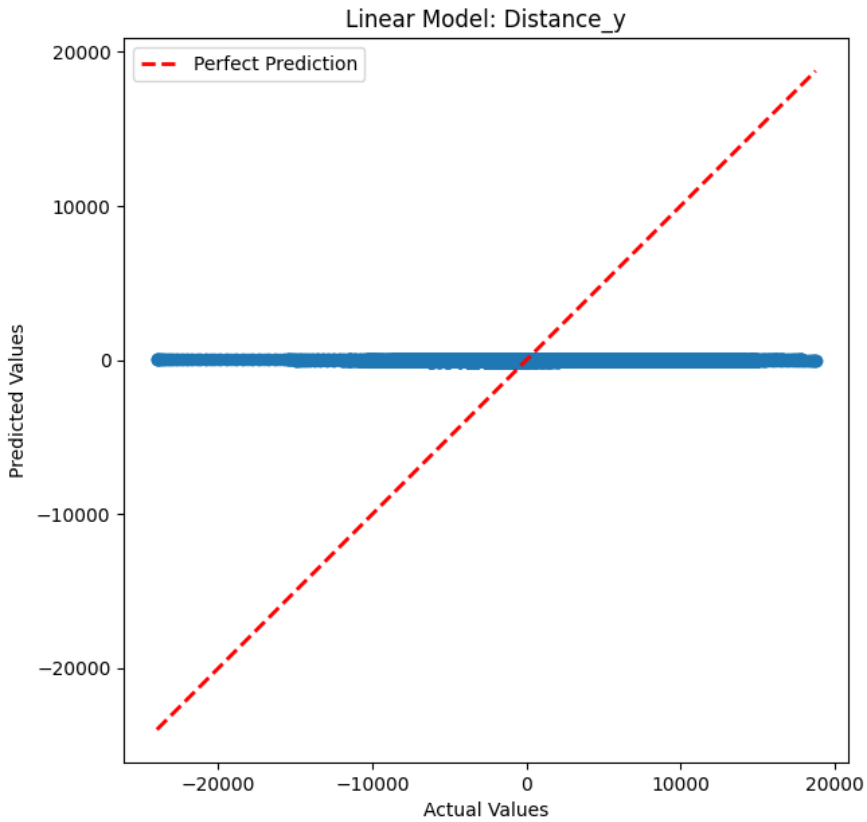
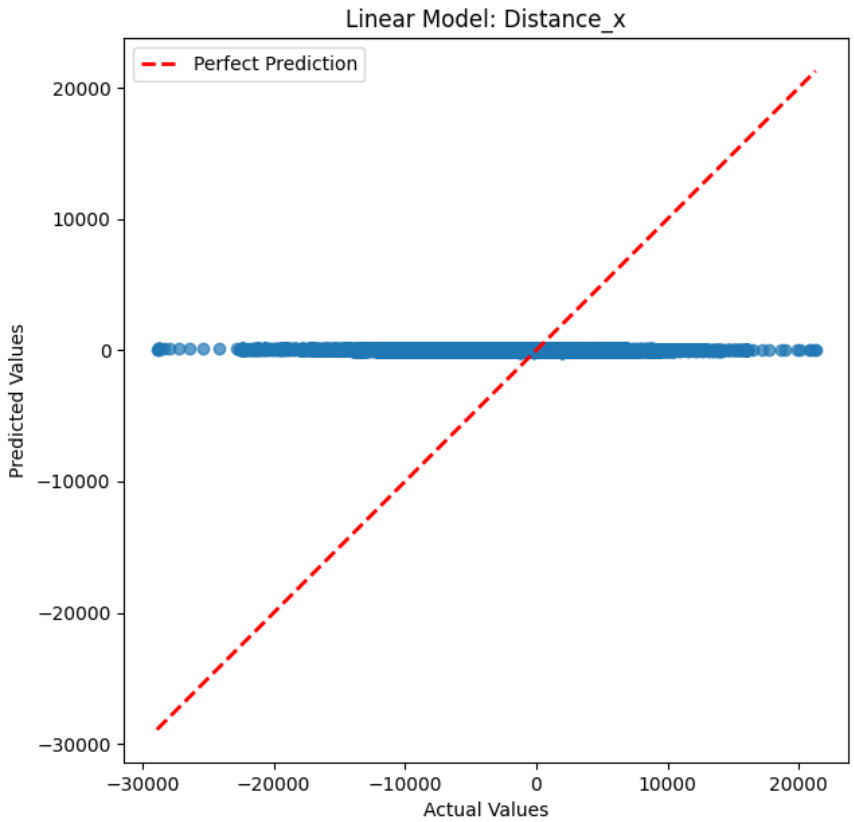
$\Rightarrow$ This can be solved using linear regression.

Agenda

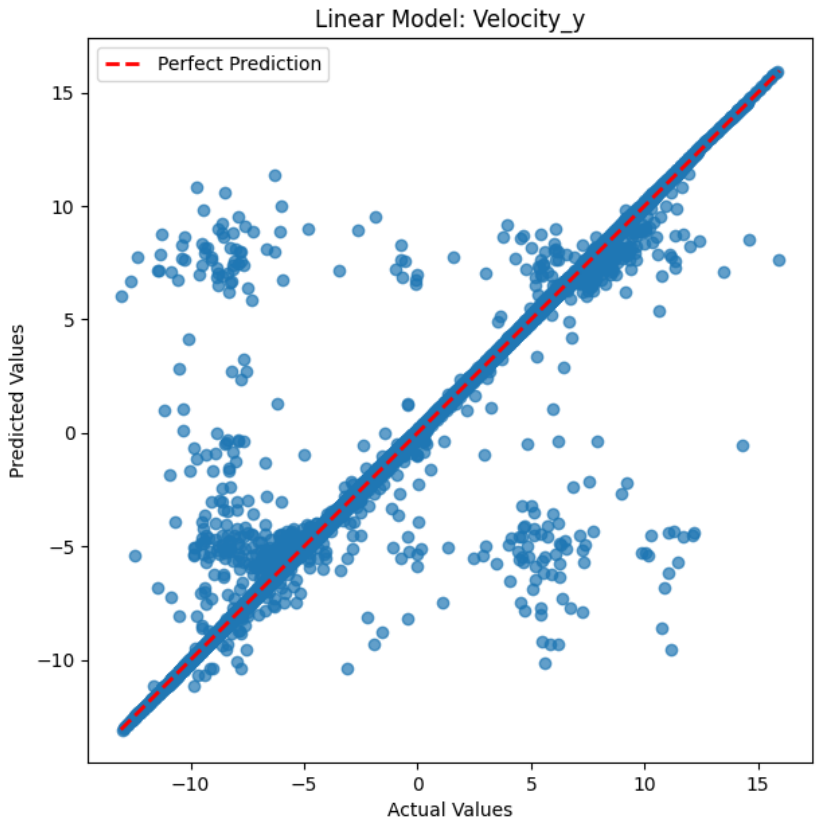
Acceleration Modification in the Y-axis



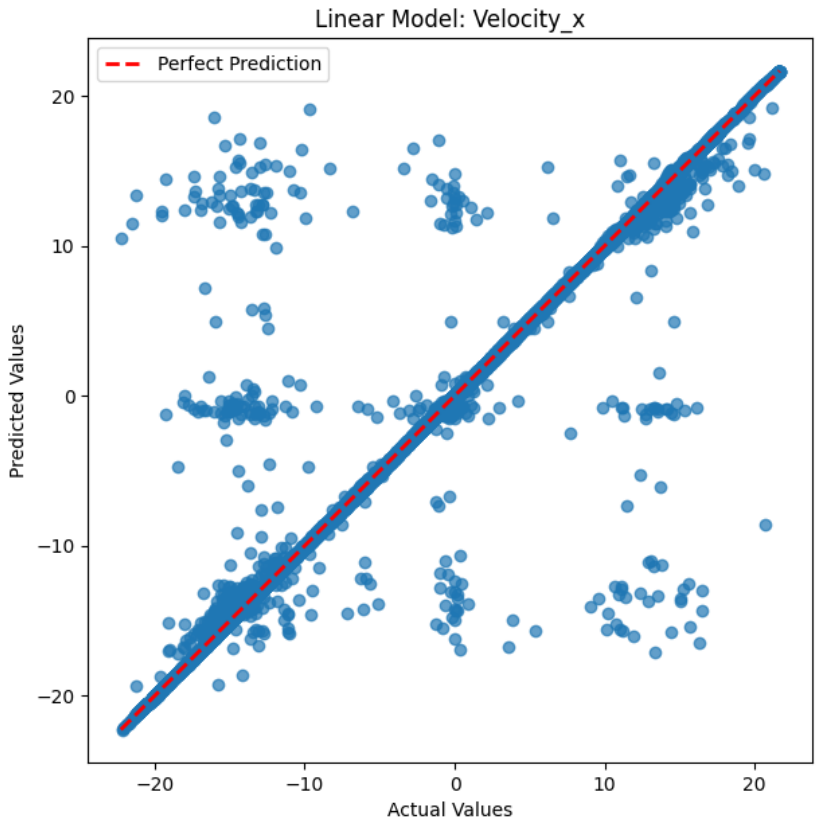
Acceleration Modification in the Y-axis



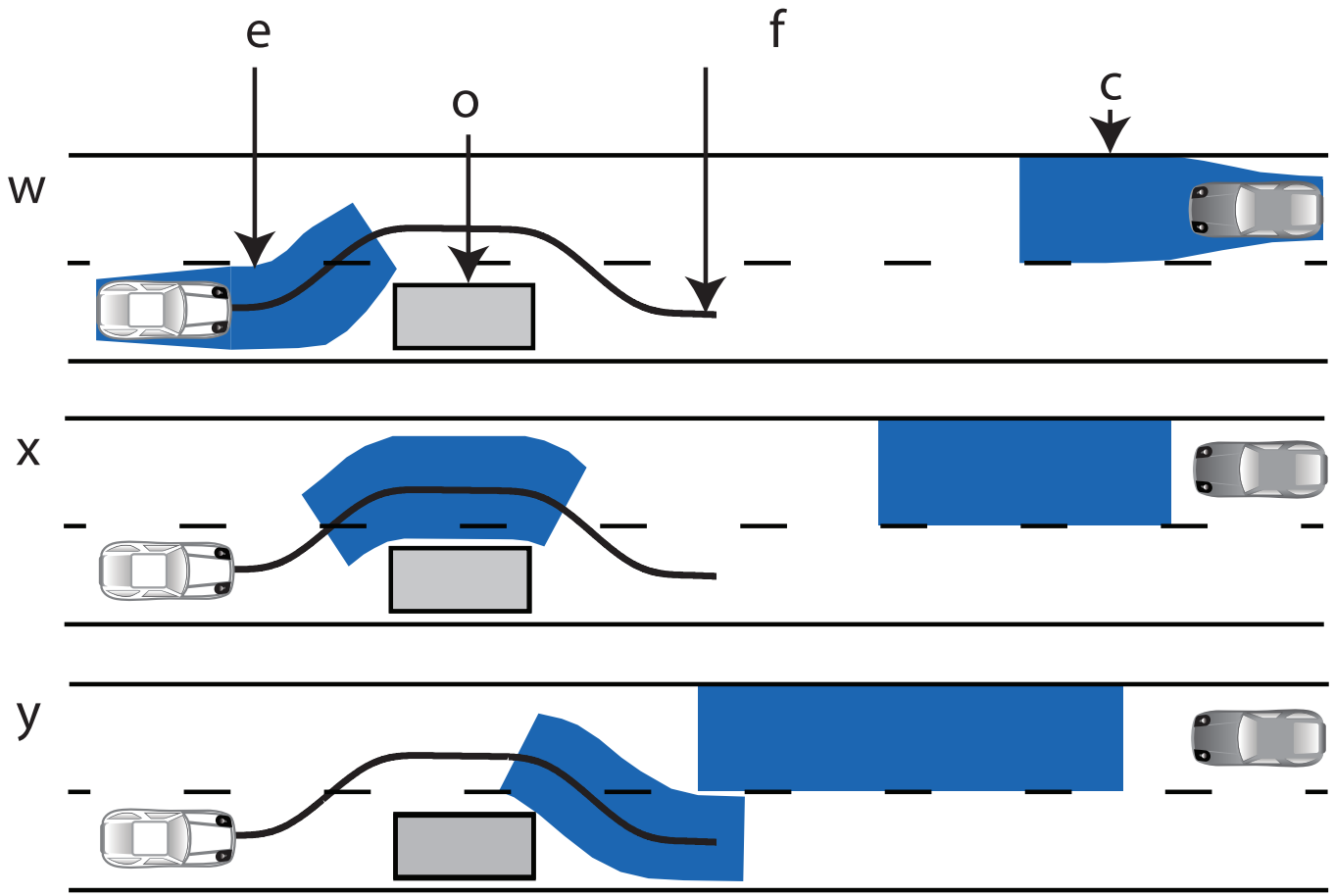
Acceleration Modification in the Y-axis



Acceleration Modification in the Y-axis



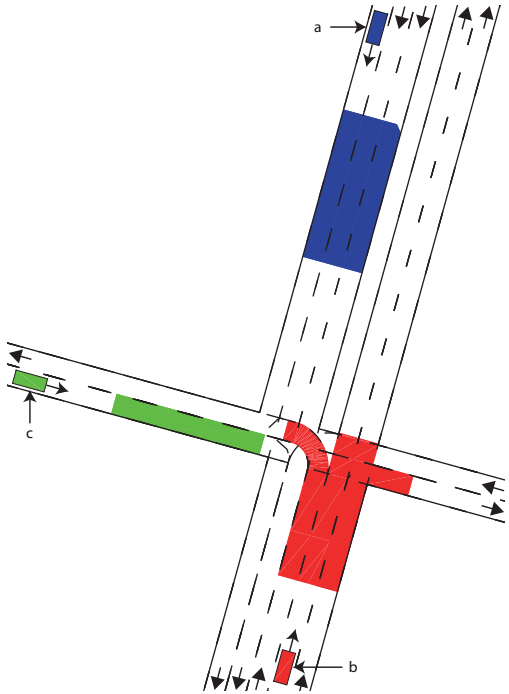
Motivation for Set-Based Prediction [1]



[1] M. Althoff and S. Magdici, "Set-based prediction of traffic participants on arbitrary road networks," IEEE Transactions on Intelligent Vehicles, vol. 1, no. 2, pp. 187–202, 2016.

SPOT

SPOT: A tool for set-based prediction of traffic participants [2]



Initial configuration and $\mathcal{O}(t)$ for $t \in [1.5\,\mathrm{s}, 2.0\,\mathrm{s}]$

[2] M. Koschi and M. Althoff, "SPOT: A tool for set-based prediction of traffic participants," in Proc. of the IEEE Intelligent Vehicles Symposium, pp. 1679–1686, 2017.

Conclusions

- Item
- Item
- Item

Thank you for your attention:)