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Reactive Gaze during Locomotion in Natural Environments - Poster

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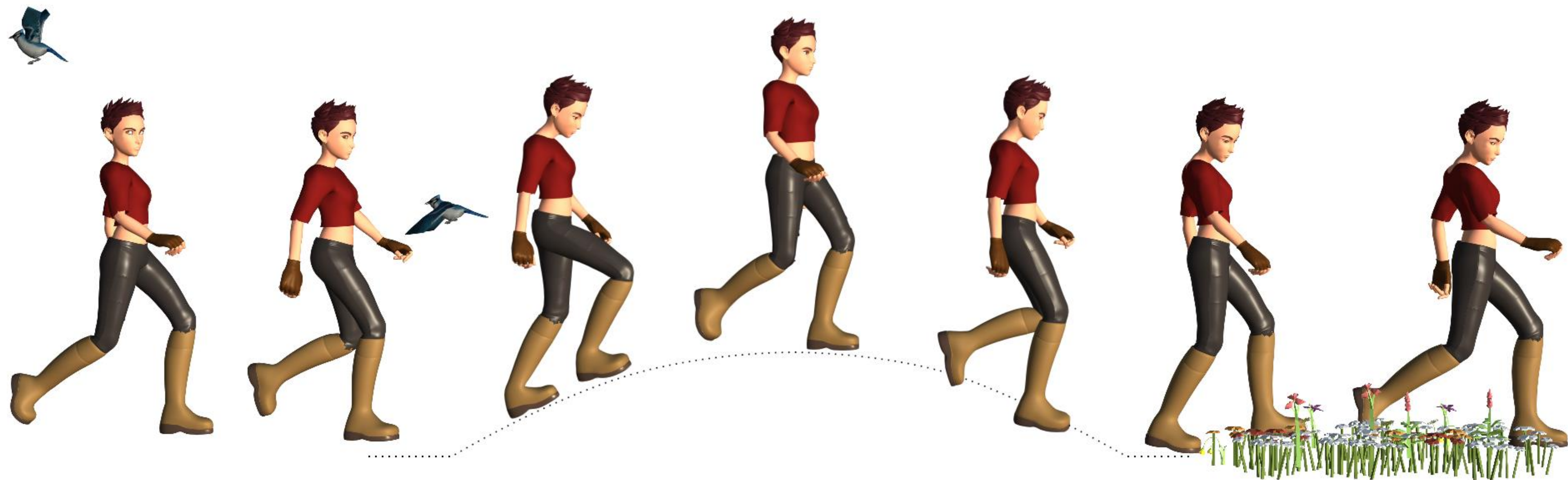
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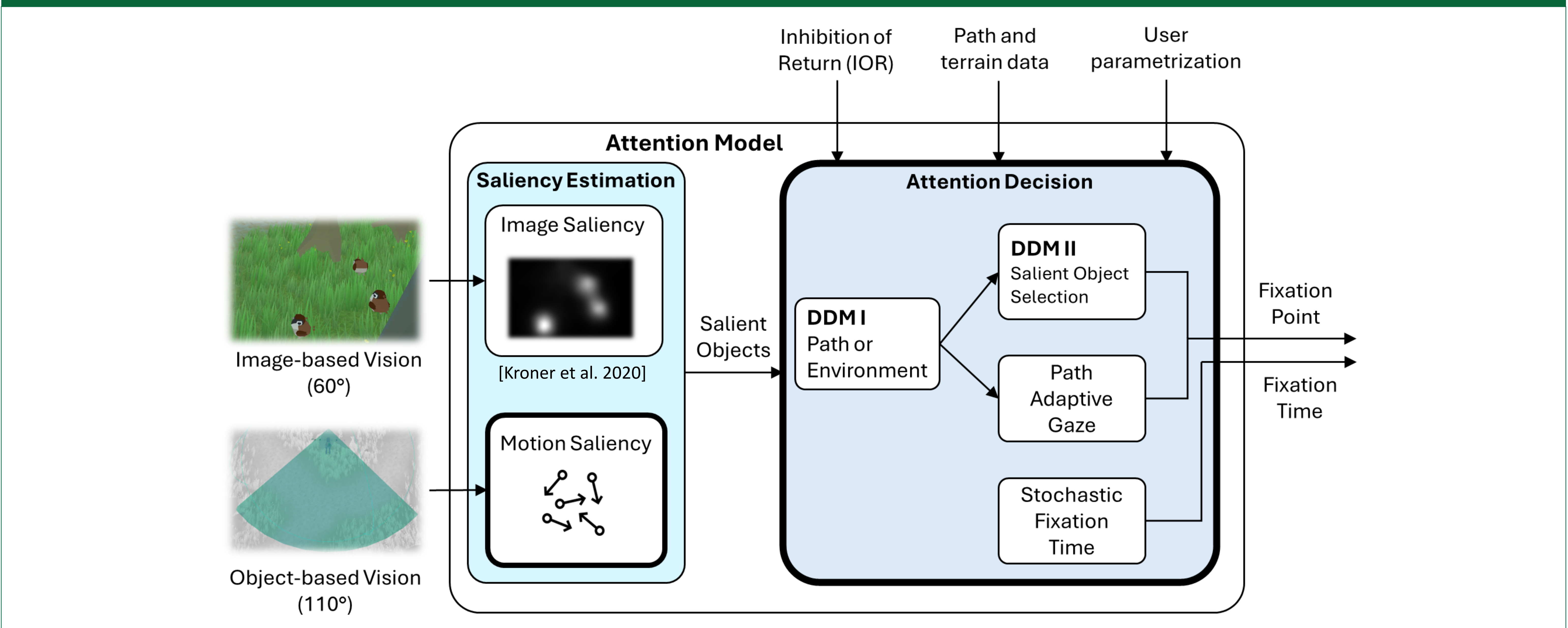
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Our visual attention model considers the character's path, the slope of the terrain, and the salience of shapes and motion of surrounding elements.

OVERVIEW

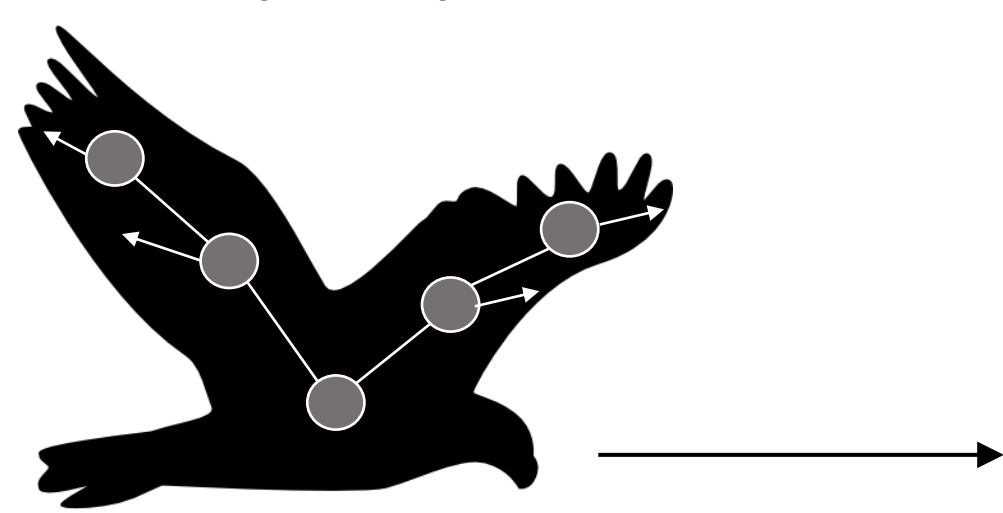


MOTION-AWARE SALIENCY ESTIMATION

We expand upon a previous perceptual study [Arpa et al. 2011]

Motion Types:

- Appearance } 1.0
- Onset
- Change
- Offset } 0.2
- Continuous



- Calculate apparent velocity and acceleration $\mathbf{v}_j^a(t), \mathbf{a}_j^a(t)$
- Give each joint a motion saliency score $m_j(t)$
- Perceptual speed:

$$V_j(t) = m_j(t) (\|\mathbf{v}^{aj}(t)\| + \|\mathbf{v}^{aj}(t - \Delta t)\|) / 2$$
- Final motion saliency score of the object:

$$\begin{cases} M_i(t) = m_{j_{\max}}(t) \\ \text{where } j_{\max} = \underset{j \in [0, N_{joint} - 1]}{\operatorname{argmax}} V_j(t) \end{cases}$$

ATTENTION DECISION SYSTEM

I. The agent chooses between looking at the **path** or at the **environment**

$$\mu^{p/e}(t) = \underbrace{\alpha(t)}_{\text{Current terrain slope}} \underbrace{\delta t_{\text{path}}(t)}_{\text{Time since last path look}} - \frac{1}{N_s} \sum_{i=0}^{N_{\text{salient}}} \underbrace{\hat{S}_i(t)}_{\text{Average object saliency (with IOR)}} + \underbrace{b}_{\text{Behavioral bias}}$$

IIa. The agent chooses to look at an **object**

$$\mu_i^{\text{salient}}(t) = \underbrace{S_i(t)}_{\text{Object Saliency Score}} + \underbrace{\omega_i(t)}_{\text{Inhibition of Return (IOR)}}$$

IIb. The agent chooses to look at the **path**

$$d = d_{\max} - \frac{\alpha}{\alpha_{\max}} (d_{\max} - d_{\min})$$

RESULTS

- Implemented with C# in Unity 3D and Python
- Main overhead is communication between Unity and Python
- Interactive with user input (60 FPS)
- Two navigation modes (user input and pre-defined trajectory)



FINAL CONSIDERATIONS

Limitations

- Motion saliency relies on geometric vision
- DDM processes need to be changed to account for more factors

Future Work

- Use of optical flow for an image-based motion saliency estimation
- Coupling attention model with a full-body animation system

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