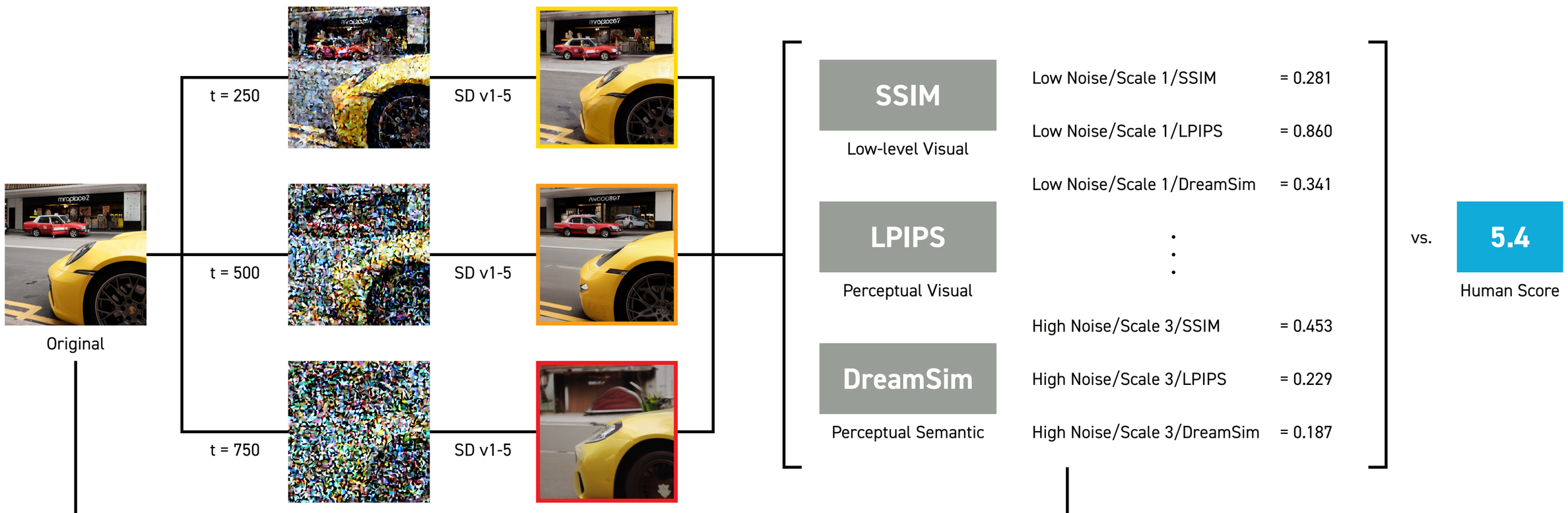


Exploring Aesthetics Through Surprise Gained from Diffusion

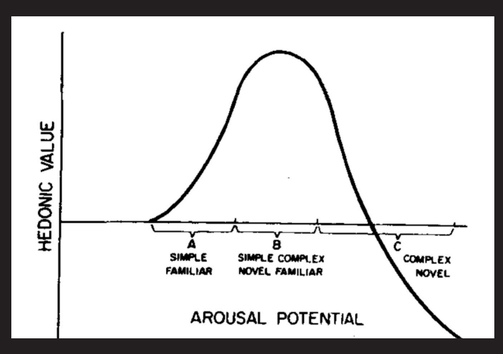
CSC2529: Computational Imaging
Final Project
Joshua (Hyun Jo) Jang
University of Toronto

UNIVERSITY OF TORONTO

Related Work

Psychologist **Daniel E. Berlyne**'s Theory of Aesthetics

University of Toronto, 1970



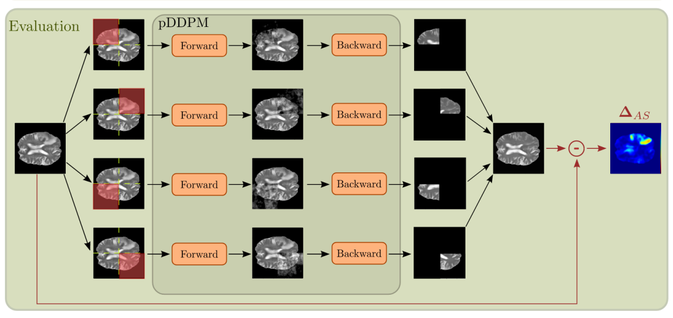
"Hedonic (aesthetic) value is maximised at a moderate amount of arousal potential (surprise)" [1]

Can we test this hypothesis with modern diffusion models?

Diffusion-Based Anomaly Detection

Unexpected regions in an image can be identified using diffusion models' inherent representation of the "expected" image.

Patched Diffusion Models for Unsupervised Anomaly Detection in Brain MRI

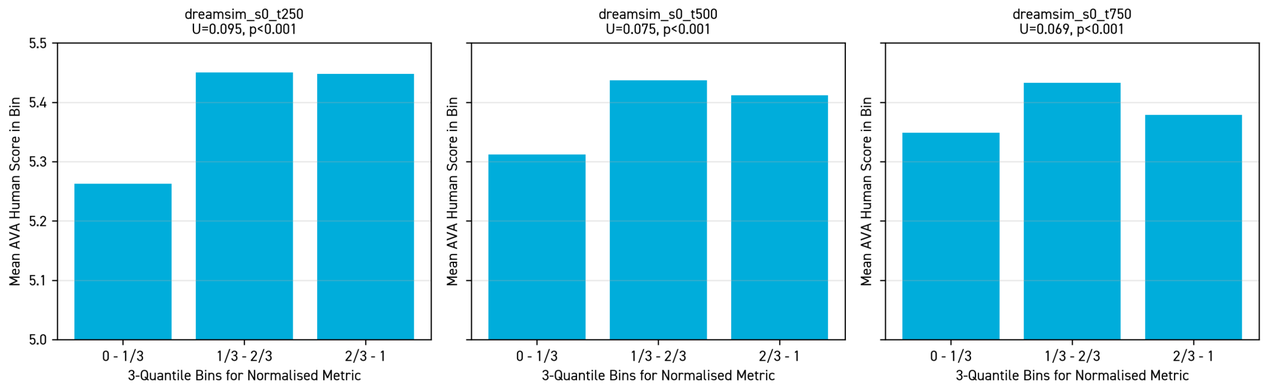


Behrendt et al. [2] found anomalous MRI scan regions by:

- **adding noise** to the scan,
- **denoising** it with a **diffusion model**, then
- **comparing** the original and reconstruction (e.g., L1)

Results

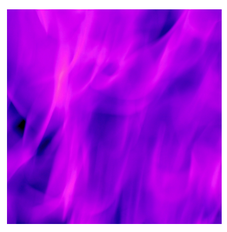
Mean metric value across AVA-score bins
(top inverted-U metrics)



The top-3 metrics **which followed Berlyne's inverted-U curve** were:

- DreamSim (high-level, CLIP backbone) at scale 0, with **low noise**
- DreamSim (high-level, CLIP backbone) at scale 0, with **medium noise**
- DreamSim (high-level, CLIP backbone) at scale 0, with **high noise**

Conclusion: ***"a moderate level of semantic deviation from expectation generally corresponds to higher aesthetic evaluations"***

Original Input	Diffusion Expected	AVA Score
		**Low (2.5)**
Small Difference		
		**High (7.6)**
Medium Difference		
		**Low (3.1)**
Large Difference		

(Using metric: DreamSim/scale 0/high noise. High noise is chosen for illustrative purposes.)

Ref.

[1] D. E. Berlyne, 'Novelty, complexity, and hedonic value', Perception & Psychophysics, vol. 8, no. 5, pp. 279–286, Sept. 1970
[2] F. Behrendt, D. Bhattacharya, J. Kruger, R. Opfer, and A. Schlaefer, 'Patched Diffusion Models for Unsupervised Anomaly Detection in Brain MRI'.
[3] N. Murray, L. Marchesotti, and F. Perronnin, 'AVA: A large-scale database for aesthetic visual analysis', in 2012 IEEE Conference on Computer Vision and Pattern Recognition, Providence, RI: IEEE, June 2012, pp. 2408–2415. doi: 10.1109/CVPR.2012.6247954.