Selective Rendering with Graphically Salient Region Detection

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Outline

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- Research Objectives
- Related Work
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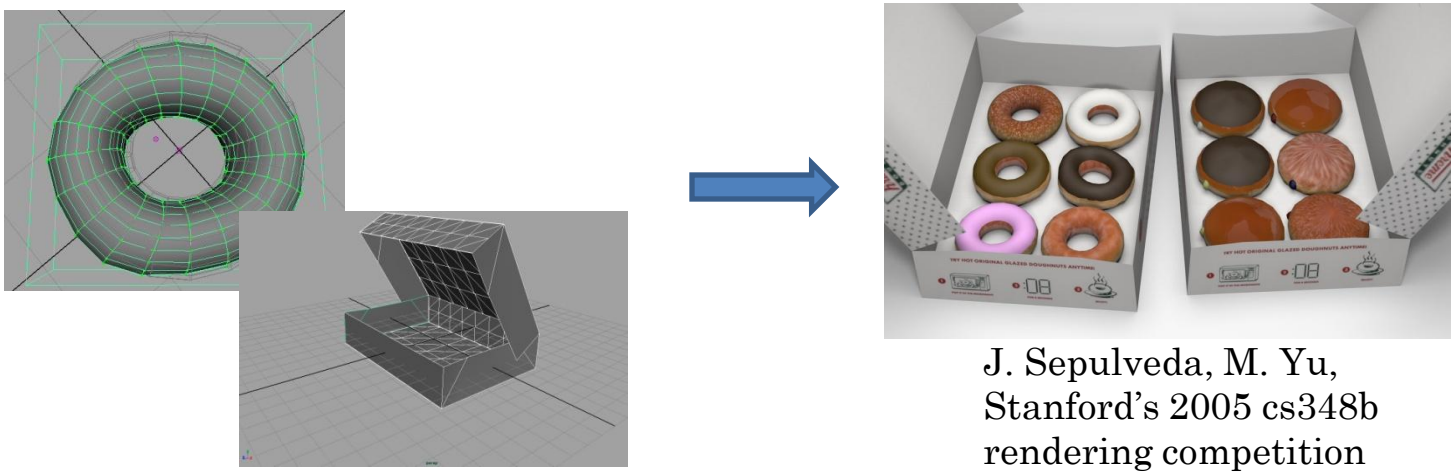
- Current Work
- Conclusion

Introduction

- Rendering
  - the process of generating an ***image*** from a ***model*** (or combination of models called a ***scene*** file), by means of computer programs
  - widely used in architecture, video games, simulators, movie or TV special effects, and design visualization



J. Sepulveda, M. Yu, Stanford's 2005 cs348b rendering competition

Introduction

- Selective Rendering
  - Goal: achieve the maximum perceived rendering quality with a given rendering computation budget
  - Method: allocate more computation resources to image regions with higher saliency

Research Objectives

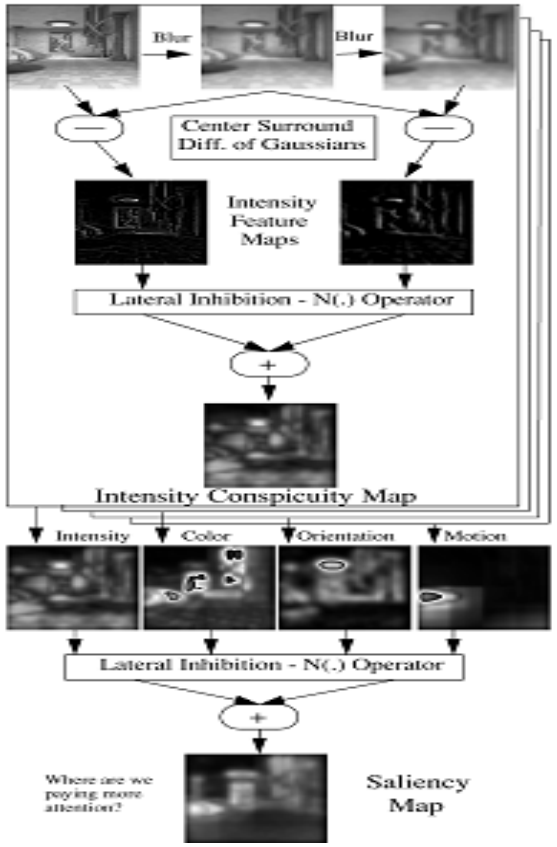
- Derive a computational saliency model which is suitable for selective rendering application by taking into account the characteristics of :
  - the human visual system(HVS)
  - the rendering process
  - the 3D object models

Related Work

Use image based visual attention model as the saliency model –

H. Yee, S. Pattanaik, D. P. Greenberg (*TOG 2001*)

- the human visual system(HVS) √
- the rendering process
- the 3D object models

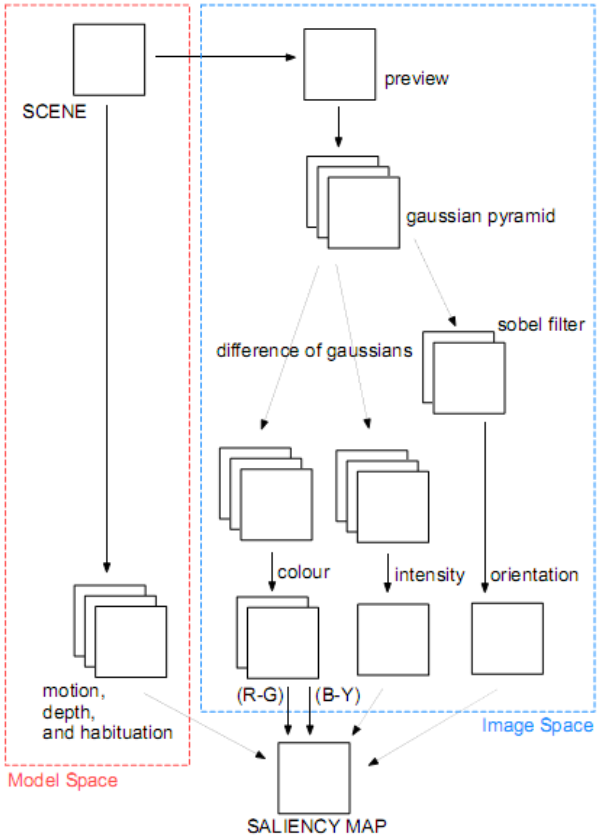


Related Work

Add model information to image based visual attention model –

A. Chalmers, K. Debattista, G. Mastoropoulou, L.P. Santos (*IJVR 2007*)

- the human visual system(HVS) √
- the rendering process
- the 3D object models √

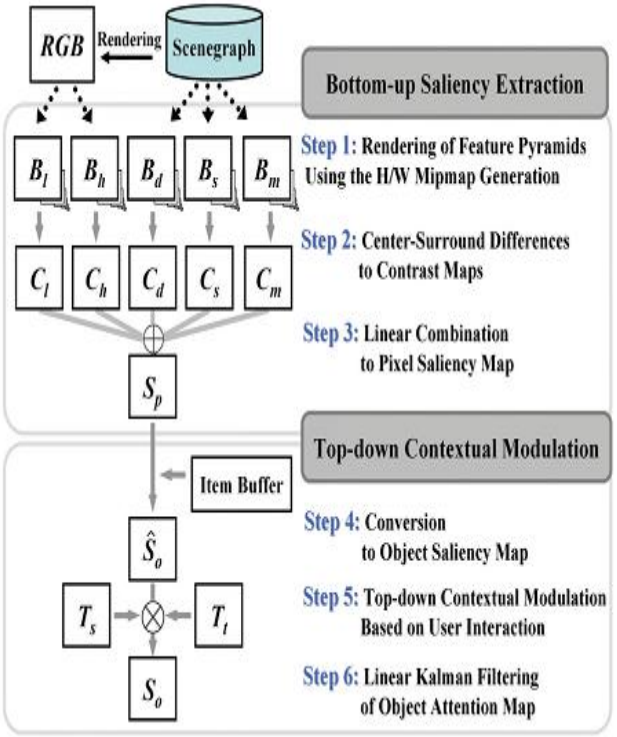


Related Work

Add top-down information to image & model information based visual attention model –

S. Lee,G. J. Kim, S. Choi (*TVCG 2009*)

- the human visual system(HVS) √
- the rendering process
- the 3D object models √



Research Gap

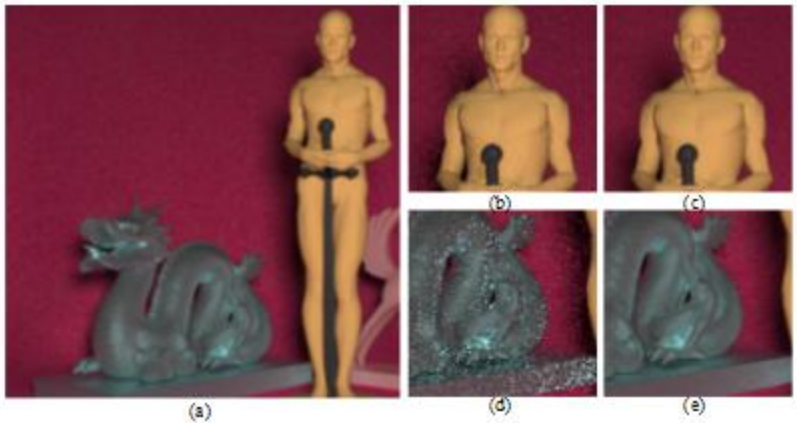
- The characteristics of the rendering process has not yet been considered in existing saliency models
- The object model information is not fully nor systematically used
- For the characteristics of human visual system, only the visual attention mechanism has been used

Current Work

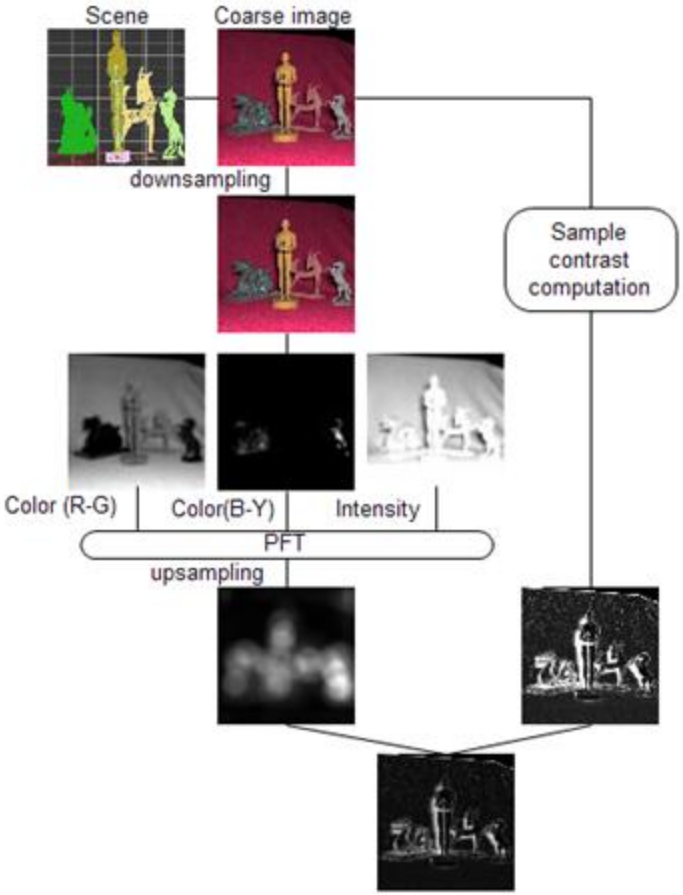
Propose a saliency model which takes into account both the human visual attention mechanism and characteristics of the rendering process

Characteristic of rendering process:

- Time-constraint: phase of Fourier transform(PFT) based VA model (C. Guo *et al. CVPR 2008*)
- Rendering complexity: sample contrast metric

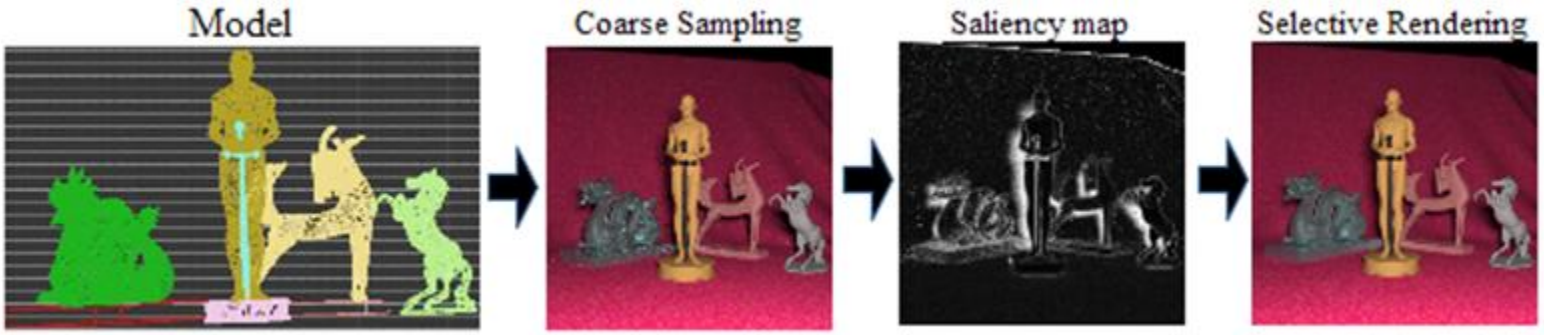


Current Work



Current Work

- Based on the proposed graphic saliency model, the proposed selective rendering pipeline is like:



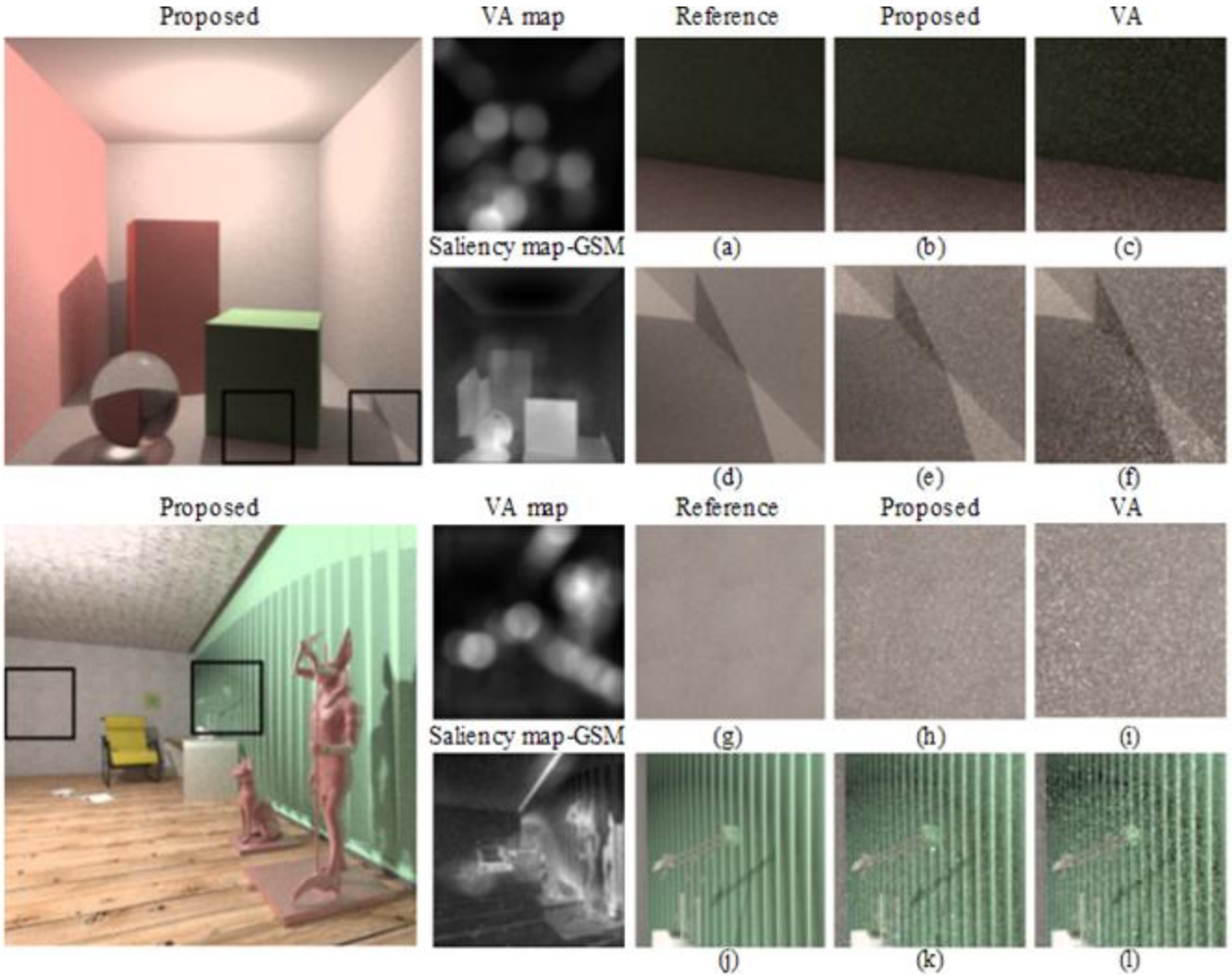
Current Work

Experiment Objective:

Comparing images rendered selectively using the proposed graphic saliency model and using the visual attention model

- Objective quality evaluation – PSNR (Peak Signal Noise Ratio)
- Subjective viewing test – ΔMOS (Mean Opinion Score)

Current Work



PSNR (in dB) for both the proposed saliency model based and the VA based selective rendering

		High VA	High Complexity	High VA & complexity	Overall
Cornell	GSM	32.87	34.14	33.92	35.09
	VA	34.52	32.23	32.52	33.41
Statues	GSM	38.65	35.89	37.78	40.58
	VA	38.67	33.11	36.49	38.77
Dragons	GSM	31.30	30.19	30.68	35.16
	VA	30.24	28.78	29.41	33.91
Sponza	GSM	28.47	27.99	28.05	28.19
	VA	31.52	27.32	27.67	27.58
Killeroos	GSM	38.93	36.92	37.86	39.83
	VA	40.92	35.14	37.20	38.34
Room	GSM	32.76	30.97	31.90	32.60
	VA	34.45	26.73	29.53	30.65
Average PSNR improvement for proposed (over VA)		**-1.22**	**2.13**	**1.23**	**1.46**

Subjective quality evaluation results (the proposed saliency model against the VA model)

	ΔMOS (the proposed saliency model against the VA model)	
	Mean	Standard Deviation
	VA	VA
Cornell	1.474	0.772
Statues	1.421	0.902
Dragons	0.105	0.658
Room	1.632	1.012
Sponza	1.105	1.487
Killeroos	0.105	1.150
Average	**0.974**	0.997

Conclusion

- For efficient selective rendering, a proper saliency model which considers the characteristics of the human visual system, the rendering process and the 3D object models is needed

- Currently, we have proposed a graphic saliency model by incorporating a metric gauging the rendering complexity into a visual attention model

- For future work, we will further exploit the characteristics of 3D models and turn the image-based saliency model to model-based saliency model

Thank you for listening!

Any questions or suggestions?

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