Evaluating Context-Aware Saliency Detection Method

Christine Sawyer
Santa Barbara City College
Computer Science & Mechanical Engineering
Mentors: Jiejun Xu & Zefeng Ni
Advisor: Prof. B.S. Manjunath
Vision Research Lab

Funding: Office of Naval Research
Defense University Research
Instrumentation Program
What is Visual Saliency?
What is Visual Saliency?

- **Visual Saliency** – Subjective perceptual quality which makes certain items stand out more than others.
What is Visual Saliency?

- **Visual Saliency** – Subjective perceptual quality which makes certain items stand out more than others.
- **Mimic human perception**

Original Image  Human Fixations  Bruce et al.
Learning gaze patterns by tracking eye movement

- Using EyeLink1000 as a tool
  - High Speed Infrared Camera
  - Illuminator
Learning gaze patterns by tracking eye movement

- Using EyeLink1000 as a tool
  - High Speed Infrared Camera
  - Illuminator
Learning gaze patterns by tracking eye movement

- Using EyeLink1000 as a tool
  - High Speed Infrared Camera
  - Illuminator

- Potential applications
  - Image Segmentation
  - Image Retargeting
  - Image Search & Retrieval
Learning gaze patterns by tracking eye movement

- Using EyeLink1000 as a tool
  - High Speed Infrared Camera
  - Illuminator

- Potential applications
  - Image Segmentation
  - Image Retargeting
  - Image Search & Retrieval
Looking at the context of an image
Looking at the context of an image

- Sometimes looking just dominant object is not enough.
Looking at the context of an image

- Sometimes looking just dominant object is not enough.
- Context-Aware Saliency - Extract salient object with its surroundings that add meaning to image.
Context-Aware Saliency Detection

- 4 basic principles of human visual attention
Context-Aware Saliency Detection

- 4 basic principles of human visual attention
  - Use eye tracker to evaluate algorithm
    - What do people look at to determine the scenario of image?

[Goferman et al.]
Context-Aware Saliency Detection

- 4 basic principles of human visual attention

  - Use eye tracker to evaluate algorithm
    - What do people look at to determine the scenario of image?
    - Viewing Time
    - Categories

[Goferman et al.]
The effects in lengths of time

2 Seconds
The effects in lengths of time

- In depth analysis
  - Dominant object
  - Surroundings

5 Seconds
How categories affects how you look

• Sports
  – Person(s) participating
  – Sports equipment
How categories affect how you look

- Sports
  - Person(s) participating
  - Sports equipment
Insight from preliminary experiments

• Need to give test participants a specific task
  – People aimlessly search images when given no task.
  – People get distracted based on prior knowledge.
Insight from preliminary experiments

• Need to give test participants a specific task
  – People aimlessly search images when given no task.
  – People get distracted based on prior knowledge.
Insight from preliminary experiments

• Need to give test participants a specific task
  – People aimlessly search images when given no task.
  – People get distracted based on prior knowledge.

• Time constraints
  – 4 seconds
Experimental Process

• 60 images from various categories shown for 4 seconds to each of the 17 viewers.
Experimental Process

- 60 images from various categories shown for 4 seconds to each of the 17 viewers.
Experimental Process

- 60 images from various categories shown for 4 seconds to each of the 17 viewers.
- Task: Look at the parts that best describe the image and give brief description of scene.
Experimental Process

• 60 images from various categories shown for 4 seconds to each of the 17 viewers.

• Task: Look at the parts that best describe the image and give brief description of scene.

• Goal: Evaluate Context-Aware Saliency and create a data set that can provide ground truth data.
Categories of Results

• Algorithm matches human perception

• Algorithm partially matches human perception

• Algorithm does not match human perception
Algorithm matches human perception

- Image has simple background
- Salient portion(s) have distinct differences in color and/or texture

![Original Image](image1)

![Context-Aware Saliency Algorithm](image2)
Experiment Results
Matching human perception
Matching human perception
Matching human perception
Algorithm misses part of the salient portion

• Image has simple foreground
  – People look more at high level features like faces
  – The salient portion could be a similar color and/or texture as its surroundings
Experiment Results
Partially matching human perception
Partially matching human perception
Partially matching human perception
Algorithm differs from human perception

- The image is very busy
- The dominant object is not obvious
Contrasting human perception
Contrasting human perception
Contrasting human perception
Conclusion and Future Plans

• Match to human perception
  – Simple background and distinct foreground

• Partial match to human perception
  – Plain foreground with more complex background

• Contrast to human perception
  – Busy image
  – Unclear main object
Conclusion and Future Plans

• **Match to human perception**
  – Simple background and distinct foreground

• **Partial match to human perception**
  – Plain foreground with more complex background

• **Contrast to human perception**
  – Busy image
  – Unclear main object

• **Effects of...**
  – Blurring and noise in image
  – People's prior knowledge/background
References


Acknowledgements

- INSET
- Prof. Manjunath
- Jiejun Xu & Zefeng Ni
- Vision Research Lab
- Volunteers for my experiment
- Professors, Family, & Friends