**Motivation and Approach**

Color is important, but how important?
• B&W tv works, people understand it.
• Would being a monochromat affect object recognition?
• How does being a dichromat affect object recognition?

**Possible Psychophysical Approach**

Conduct psychophysical experiments with human subjects in a large number of situations to see how color affects performance.

**Our Approach**

Measure how the accuracy of deep-learning-based, object-classification methods is affected when:
1. monochromatic (i.e., CIE Y) images are used;
2. dichromatic (i.e., LS) images are used;
3. illumination-induced color changes are included.

**Method Details**

- The test and training images are from CIFAR dataset [4].
- 60,000 images in 100 classes.
- 50,000 for training and 10,000 for testing.
- CIFAR nominally in non-linear sRGB format
  - Convert to linear sRGB [3]
  - Convert sRGB to XYZ
  - Convert XYZ to LMS via HPE matrix [1]
- Illumination variation added to images
  - Random von Kries scaling of RGB
  - Linearly interpolated across image

**Experiment**

- Datasets:
  - CIFAR: 50k for training and 10k for testing
  - COCO: 41k images for validation (i.e., tuning)
- Simulated variation in illumination colour across image
  - Example —>

**Comparative Classifications**

<table>
<thead>
<tr>
<th>LMS</th>
<th>LS</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.8</td>
<td>33.1</td>
<td>35.0</td>
</tr>
<tr>
<td>52.4</td>
<td>51.4</td>
<td>48.0</td>
</tr>
<tr>
<td>31.3</td>
<td>33.0</td>
<td>35.0</td>
</tr>
</tbody>
</table>

**Conclusions**

- Color is important, but not essential, for object classification.
- Color makes results more sensitive to illumination colour variation.
- With varying illumination only 12% increase in error for b/w v.s. colour.
- Dichromatic classification only 5% worse than trichromatic.
- With varying illumination - 33.0 (LS) versus 31.3 (LMS)

**References**


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