

Region Visualization

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Image segmentation and region identification is an important part of most computer vision applications. Several VisionX tools are available to simplify the visualization process



The visualization issue is illustrated in the binary image above; the outcome of a segmentation is a binary image. Displaying just that image, in general, provides limited useful information

See slide 3 for best methods

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Region Visualization: Images

Task: to visualize and compare two different segmentations

Original Image: car.vx



Segmentation A: carA.vx



Segmentation B: carB.vx

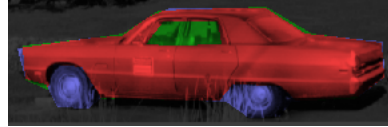


VisionX-V4 vrdiff

Region Visualization: Best methods region

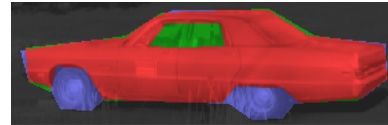
Task: to visualize A single segmentation

In general the best method is to add to the grey level image



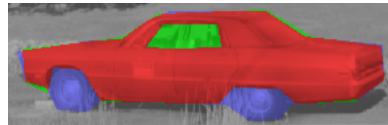
```
%vrdiff carA.vx carB.vx -cs of= | vccvt -i | vcmof ig=car.vx of=carVCx.vx
```

Dynamic intensity mapping may be better for images with high dynamic range



```
%vrdiff carA.vx carB.vx -cs of= | vccvt -i | vcmof -d ig=car.vx of=carVCy.vx
```

A simple color index image may be generated by vrdiff



```
%vrdiff carA.vx CarB.vx ig=car.vx -ci of=carVCr.vx
```



VisionX-V4 vrdiff, vcmix, vmpix

Region Visualization: Region comparison

Task: to quantitatively compare two different segmentations

```
%vrdiff carA.vx CarB.vx -sh  
apcnt=13145;  
bpcnt=14165;  
overlap=12061;  
anotb=1084;  
bnota=2104;  
union=15249;  
diff=3188;  
tp=12061; tn=12011;  
fp=1084; fn=2104;  
fpc=0.7749;  
sim=0.79093;  
sens=0.851464;  
spec=0.917220;  
dsc=0.883266;
```



carA.vx



carB.vx

Vrdiff: provides both a quantitative analysis of the two binary images and various visualizations.

For of the analysis shown on the left see the crdiff man page. Be sure that the metric you use is the correct one for the application

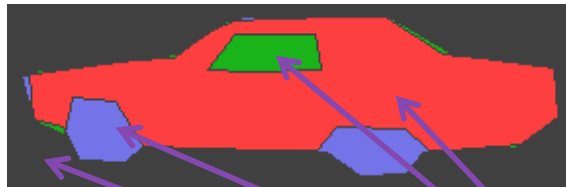


VisionX-V4 vrdiff

Region Visualization: Region comparison

`vrdiff` region matching color scheme

```
%vrdiff carA.x carB.vx -cs of=carVC1.vx
```



A and B
A and not B
B and not A
not A and not B

Matched regions are shown in red



VisionX-V4 *vrdiff*

Region Visualization: single region

Task: to visualize A single segmentation

In general the best method is to add to the grey level image



```
%vrdiff carA.vx CarA.vx ig=car.vx -ci of=carVCr.vx
```

In some case an outline may be better.



```
%vmpix car.vx carA.vx | vcmix car.vx of=carV2.vx
```

On overlay is possible but other methods are better.



```
%vcmix car.vx carA.vx of=carV1.vx
```



VisionX-V4 *vrdiff, vcmix, vmpix*

Region Visualization: single region (no color)

Task: to visualize A single segmentation

If color is not available then an outline may be best*.



```
%vmix if=carA.vx of=tmp  
%vcmix ig=tmp car.vx of=carVg2.vx -g
```

In some case, especially in the case of many small regions an overlay may be better.



```
%vmix car.vx carA.vx | vcmix car.vx of=carV2.vx
```

* Vcmix cannot accept a pipe to its if= input.



VisionX-V4 *vrdiff, vcmix, vmix*

Region Visualization: single region (color image)

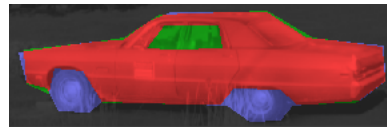
Task: to visualize A single segmentation

If the original image is already in color then convert to gray first in order to show regions



```
%vchan -c if=carc.vx of=car.vx  
%vrdiff carA.vx carB.vx -cs of= | vccvt -i | vcmod ig=car.vx of=carVCx.vx
```

And for a single region just repeat the name



```
%vrdiff carA.vx carA.vx -cs of= | vccvt -i | vcmod ig=car.vx of=carVCx.vx
```

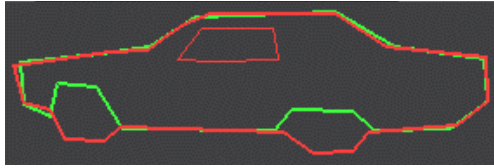
Presenting the original image next to the segment visualization is often a good idea.



VisionX-V4 *vrdiff, vcmix, vmix*

Other Region Visualizations: color boundaries

Task: to visualize and compare two different segmentations



```
%vpix if=carA.vx i2=carB.vx | vcmap lf=colormod4 of=carVC3.vx
```



```
%vpix if=carA.vx i2=carB.vx | vcmix if=car.vx of=carVC4.vx
```



VisionX-V4 vrdiff

Other Region Visualizations: grey options

Task: to visualize and compare two different segmentations



```
%vpix carA.vx tf=0 | vrdiff if=carA.vx ig=car.vx -ci of=carVCg.vx
```



```
%vpix carA.vx tf=0 | vrdiff bf=carA.vx ig=car.vx -ci of=carVCg.vx
```



VisionX-V4 vrdiff

Other Region Visualizations: other colors

Task: to visualize and compare two different segmentations



```
%vcmix car.vx carA.vx of=carVg1.vx -g
```



```
%vpix if=carA.vx of=tmp  
%vcmix ig=tmp car.vx of=carVg2.vx -g
```



VisionX-V4 *vrdiff*

Region Visualization: Summary

- *vrdiff* is the key to good visualizations; see slide 3 for the best methods
- *vcmod* may be used with *vrdiff* to provide high quality true color visualizations. *vcmod* also can manage non-byte images and images with large dynamic ranges
- Many alternative methods for region visualizations are possible and may be appropriate in special situations
- *vrdiff* may also provide a quantitative comparative analysis of regions



VisionX-V4 *vrdiff*