Finding Objects by Background Removal

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Isolation in Complex Scenes

Threshold problems with image I:

- Many objects
- Space varying illumination

If have constant background image B (ie. before actions)
Try: $thres(\mid I - B \mid)$ instead of $thres(I)$

Colour Differencing Example 1

Do in each of 3 colour channels:
$thr(\mid I_r - B_r \mid) \parallel thr(\mid I_g - B_g \mid) \parallel thr(\mid I_b - B_b \mid)$



BACKGROUND FOREGROUND DIFFERENCE

Colour Differencing Example 2


Before After

Subtract prestored background and threshold
Algo: change=open(2,coloror(thr(35,abs(Before-After))))
(Use HS of HSI instead of RGB if illumination changes?)

Colour Differencing Results 2

Red change

Green change

'OR'ed change

'Open'ed

Coping with Varying Lighting

Use normalised RGB:

$$(r, g, b) \rightarrow (\frac{r}{r+g+b}, \frac{g}{r+g+b}, \frac{b}{r+g+b})$$

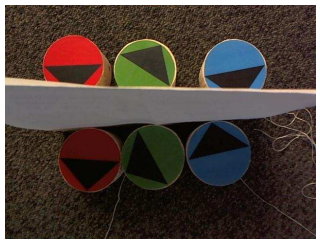
Double illumination still gives same normalised RGB:

$$(\frac{r}{r+g+b}, \frac{g}{r+g+b}, \frac{b}{r+g+b})$$

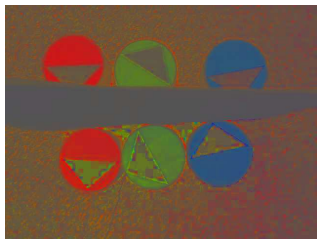
$$= (\frac{2r}{2r+2g+2b}, \frac{2g}{2r+2g+2b}, \frac{2b}{2r+2g+2b})$$

Normalised RGB Example

Original



Normalised



Reduces shadow effects, too.

Background Ratio Isolation

If known but spatially varying illumination

Reflectance: percentage of input illumination reflected. A function of the light source, viewer and surface colors and positions.

Recall:

background(r,c) = illumination(r,c)*bg_reflectance(r,c)
object(r,c) = illumination(r,c)*obj_reflectance(r,c)

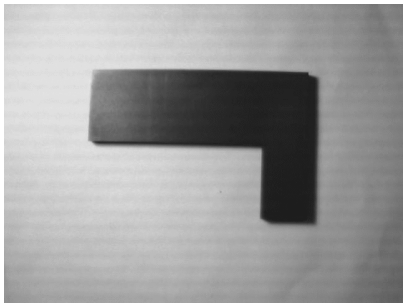
Background Ratio Isolation 2

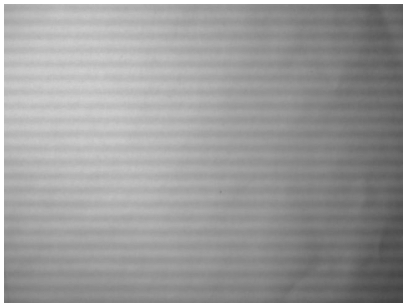
Divide to remove illumination:
unknown(r,c)/background(r,c) =

1	if unknown = background
<<1	if unknown = dark object

Pick threshold in [0,1] e.g. 0.6

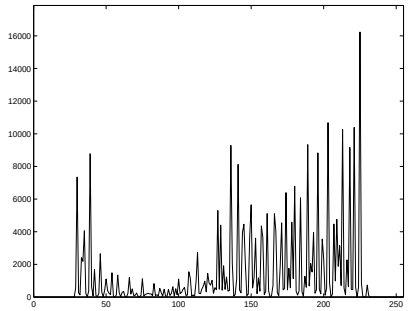
Background ratio results 1

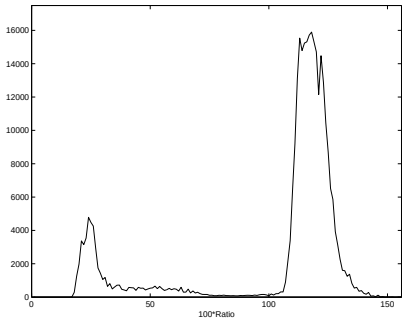




Part Background

Background ratio results 2





Raw histogram Ratio histogram

Note ragged raw and smoother ratio histograms

Background removal results 3

Has also included shadow below and right.

Lecture Overview

1. Background subtraction, including colour
2. Normalised RGB
3. Ratio with background for varying illumination

Slide credit: Bob Fisher