Oculus visualization of multispectral images

Hysperspectral camera specifications

Model: Specim IQ

Wavelength band: 400 nm – 1000 nm

Spectral resolution: 7 nm

Spectral bins: 204

Methods

The spectral data from the image is normalized to a white reference (a white object in the image). This eliminates spectral features of the source and yields a normalized reflectance spectrum. Using the CIE 1931 Standard Observer color matching functions and the spectral data we can generate the tristimulus values (RGB) and produce true color image. [1] Having access to wavelengths unperceivable to the human eye we replace the single tristimulus value R with the value R'.

$$R' = \int_{\lambda_1}^{\lambda_2} S(\lambda) d\lambda$$

Here S(λ) is the normalized reflectance spectrum and λ_1 and λ_2 can be chosen to obtain a wavelength range of choice. The replacement of R with R' results in a false color image of the infrared just imperceptible by normal human vision.

Fig 1. (a) True color image produced from the normalized reflectance spectrum. Replacing R with R' to produce a false color image where (b) λ_1 = 620 nm, λ_2= 710 nm and (c) λ_1 = 770 nm, λ_2= 810 nm.

We can project the true color image and the false color image on an Oculust Rift VR Headset.

Fig 2. Rendering of the visualization of multispectral images in an Oculus Rift VR Headset.

Conclusion

We can visualize multispectral images in an Oculust Rift VR headset potentially allowing humans to perceive more spectral information. This technique can be used to experience different dimensionality of vision like of that in birds. [2]

References

[1] Wyszecki, G., & Stiles, W. S. (1982). *Color science* (Vol. 8). New York: Wiley.

[2] Bowmaker, J. K. (1980). Colour vision in birds and the role of oil droplets. *Trends in Neurosciences*, *3*(8), 196-199.