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Robotic Vision
Assignment 01
Due: 24-Jan-2019

Applications of image processing in the electromagnetic spectrum

Contenido

Definition of electromagnetic spectrum:

The entire range of wavelengths or frequencies of electromagnetic radiation extending from gamma rays to the longest radio waves and including visible light (Merriam-Webster dictionary).

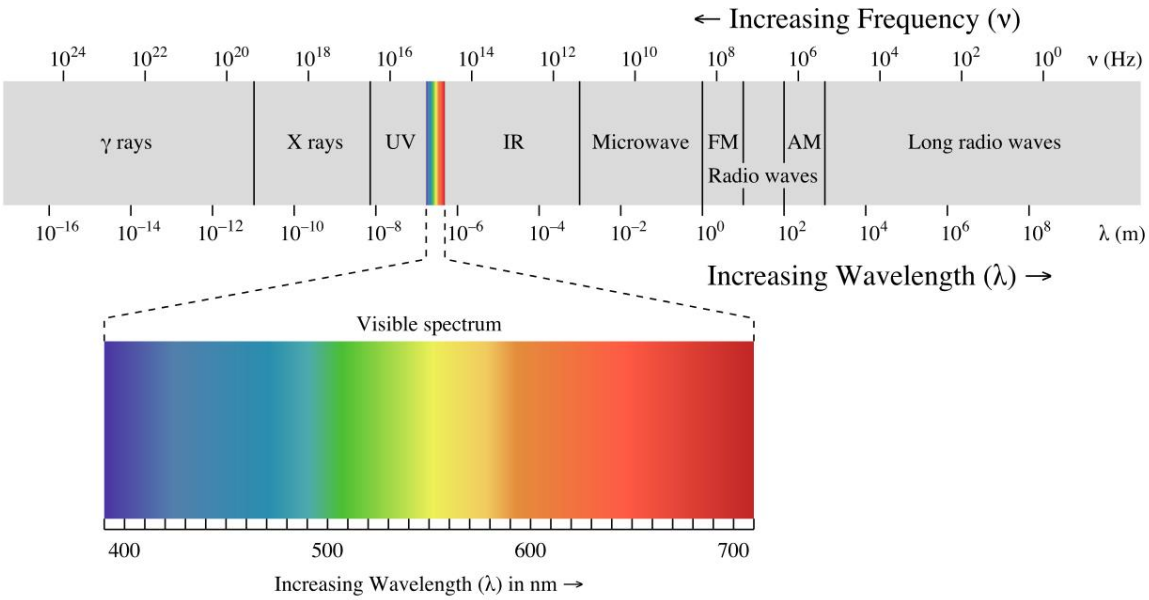

Fig 1. The Electromagnetic Spectrum

Assignment:

Applications of Image Processing are not only found within the visible spectrum using RGB cameras. Several other applications of image processing are found out of the region of the visible spectrum.

Give 5 application of image processing outside the visible spectrum including an explanation of the device used to capture the “images”.

Solution:

X-Ray:

The X-rays is a very famous way of image processing which aren't found in the visible spectrum; this is a common way of image processing using in the field of medicine, therefore, is easy to be found in several hospitals. (U.S. Department of Health and Human Services, 2018)

The X-rays is an electromagnetic wave, it's a kind of radiation. The image generated by the X-rays can be seen in black and white, this happens because the different tissues absorb different amounts of radiation. For instance, the bones and teeth (because the calcium) absorbs more radiation and seems to be whiter. As you can see in the article *Types of Dental X-rays*, published in Cleveland Clinic web page, there are several ways to use the X-rays for orthodontic purposes. (Cleveland Clinic, 2019)

The applications of the X-rays do not end on the teeth, it has a lot of fields. Another interesting application we can mention, is the X-rays crystallography. This technique helps for structure determination of proteins and biological macromolecules; this serves to improve the production of drugs. (M. S. Smyth, J. H. J. Martin, 1999)

Ultraviolet light:

The ultraviolet light (UV) in the electromagnetic spectrum is between visible light and X-rays. This light can be use in a lot of fields. The UV can be use in scientific investigations, detect bitemarks and pattern injuries, chemical process, forensic applications, shoeprint imaging, air sterilization, water treatment, detect diffuse clouds… etc. It is important to mention that the UV has enough energy to break chemical bounds and can produce cancer on the skin and can be harmful to eyes. (Marcelo Armengot, Ana Inés Gómez de Castro, Javier López Santiago, and Néstor Sánchez Doreste, 2014) (Dr. Austin Richards, 2010)

Infrared light:

The infrared light in the electromagnetic spectrum is between the visible light and the microwaves. Is a very common type of light in our day to day, it can be found in tons of things; it is invisible to human eyes, but we can feel it as heat. In fact, in industry, infrared radiation is often used for the purpose of heating.

The infrared light has several applications, beside heating, and we can find it on our day to day on thinks like the TV remote. But, a more specialized application could be, for example, the spectroscopy. Spectroscopy is a technique used in industry and in research to gauge (effectively) therefore, it can be use, for instance, for quality control in the industry. (Reusch, 2013)

Radio-wave imaging:

This image processing uses radio waves to produce images, mainly its used for medical purposes. The radio waves are sent to the patient body by a transmitter and, in the other side, there are receptors looking for the radio waves. This image processing is used because the cancer cells reflects more of this. (Micrima, 2017)

Passive Millimeter-Wave Imaging for Security

This image processing read the thermal energy in environment, but instead of infrared images, uses a longer wavelength of 3 mm, to detect a thermal energy. This is used, for security, at airports for search of weapons. (Dr. Tom Williams, 2012)

References:

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