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RESEARCH ON DIGITAL IMAGE PROCESSING TECHNOLOGY AND ITS APPLICATION

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ABSTRACT

The improvement of pictorial information for human interpretation and the processing of image data for storage, transmission, and representation for autonomous machine perception are the two main application areas that have sparked interest in digital image processing techniques. This article's goals are to define the terms "image processing" and "image processing scope," "typical image processing procedures and methodologies," and "applications of image processing tools and processes in the frontier areas of study.

Keywords: Digital Image Processing Technology Application For X-Rays, Gamma Rays, Ultraviolet (UV) Rays.

I. INTRODUCTION

An image may be described as a two-dimensional function f (x, y), where x and y are spatial (plane) coordinates. The intensity or grey level of the image at any given position is determined by the amplitude off at those coordinates (x, y). We refer to the image as a digital image when x, y, and the amplitude values off are all finite, discrete quantities. Processing digital photos using a digital computer is referred to as the field of digital image processing. You should be aware that a digital image is made up of a finite number of elements, each of which has a unique position and value. These components are also known as pixels, pels, and picture elements.

The most common term for the components of a digital image is "pixel." Images play the single most significant function in human perception, which is not surprising given that vision is the most developed of our senses. Contrary to humans, who are constrained to the visual spectrum of the Imaging devices almost completely cover the full electromagnetic spectrum, from gamma to radio waves. They are able to work with visuals produced by sources that people aren't used to connecting with images. These consist of computer-generated pictures, electron microscopy, and ultrasound.

1.1 Applications of image processing

The use of image processing is widespread across a wide range of human endeavours, from the interpretation of biomedical images to remotely sensed scene interpretation. We just give a quick overview of some of these applications in this section.

1.2 Digital Image Processing

Digital Image Processing means processing digital image by means of a digital computer. We can also say that it is a use of computer algorithms, in order to get enhanced image either to extract some useful information.

1.3 Image processing mainly include the following steps

- Importing the image via image acquisition tools.
- Analysing and manipulating the image.
- Output in which result can be altered image or a report which is based on analysing that image.

II. GAMMA RAYS

Gamma rays pack the most energy of any wave and are produced by the hottest, most energetic objects in the universe.

2.1 Introduction of Gamma rays

Radio waves and gamma rays are examples of electromagnetic radiation. Microwaves, X-rays, infrared, and ultraviolet light. Astronomers study gamma-ray bursts and gamma rays can be utilized to treat cancer.

Gamma rays are released from a nucleus or when a positron is destroyed by an electron. Radioactive sources are the most potent gamma ray emitters. The photons produced when nuclei are de-excited range in energy from less than 1 to around 20 MeV.

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The photons produced by annihilation events can have substantially higher energies. For instance, the neutral pion (0) produces two photons with an energy of around 70 MeV each.

Ionizing electromagnetic radiation known as gamma rays is produced when an atomic nucleus decays. Because they can penetrate farther into solid objects, gamma rays can significantly harm living cells. Gamma rays are employed in the nuclear industry, as well as in the fields of industry, radiation therapy, and sterilization. Gamma rays can cause cancer, eye illnesses, blood or skin ailments, and shielding against them is crucial.

Depending on the photon's energy, there are three primary categories of gamma ray interactions with matter. The photoelectric effect, Compton scattering, and pair creation are these three mechanisms. Everything leads to the photon's energy being transferred to electrons, who subsequently lose energy through further interactions.

2.2 Medical Physics Applications

Radiotherapy and/or ionising radiation therapy are the main uses of radiation in medicine. Over a century after X-rays were first discovered, it has been obvious that biological action radiation can be utilized to cure tumours.

2.3 Gamma Rays Used in Medicine

Any living thing can be killed by gamma rays. It is employed as a benefit in the medical area, particularly oncology. To combat cancer Cancer patients are treated with these beams. In a procedure known as radiation, high doses of gamma rays are administered to eliminate the malignant cells. A concentrated gamma ray beam is utilized in this procedure to destroy the DNA of malignant cells. These intense rays ionize the water within the malignant cell, resulting in the production of H and OH free radicals.

The extremely reactive free radicals interact with one another and damage the cell's DNA. The radiation oncologist's main goal is to direct the radiation beam as closely as possible to the malignancy in order to minimize adverse effects.

They are used to treat cancers by sending a high-energy photon directly to the intended tumour, sparing the surrounding tissues from damage. Patients with cancer and tumours receive intensive care. Sanitizing medicinal apparatus. Gamma rays can easily penetrate the packaging of medical equipment and destroy biological tissues, including bacteria and viruses.

2.4 Sterilization of objects by gamma radiation

Radiation of surgical and food supplies: Radiation is privileged method for eliminating microorganisms (fungi, bacteria, virus, etc.). As a result, several applications radiation exists for sterilization of items. For instance, today's disposable syringe and other medical-surgical equipment are radio-sterilized by specialized

Industrialists. Similar to this, irradiating food items improves food safety by sterilizing spices and getting rid of salmonella in shrimp and frog legs. Food ionization is another name for this technique.

Irradiation of artefacts: Using gamma to treat artefacts helps to get rid of any germs, or larvae living inside of them, preventing deterioration. This method is applied to the conservation and restoration of artistic artefacts as well as to ethnology and archaeology. It maybe used with a variety of materials, including leather, stone, and wood.

III. X-RAY DIGITAL IMAGE PROCESSING

Digital image processing is the process in digital X-ray images to enhance or suppress specific parts of an image in order to provide a clear diagnosis.

3.1 X-ray image processing: X-rays produced

The image below shows an X-ray tube, which is used to create X-rays. It is a vacuum tube that can produce X-rays from an electrical input. A revolving cathode or filament, which is an electrode that is negatively charged, and an anode, which is an electrode that is positively charged, are both present in the vacuum chamber.

At the cathode, or negative terminal, hot filament heats up and releases its electrons. Thermionic emission is another name for this. When a metal's electrons receive a significant thermal energy transfer, the metal's electrons release the thermal energy as thermoionic emission.

1. The positively charged anode is the target of electric beam.

2. Between the two electrodes, a voltage of around 200 kiloelectronvolts (keV) develops.

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3. After impacting the anode at high speed, the electrons lose around 1% of their kinetic energy, which is converted into X-ray photons. The outer shell electrons travel to lower energy levels and release the energy.

4. Heat is created from the leftover energy. To prevent overheating, the tungsten anode rotates at 3000 revolutions per minute.

3.2 X-ray images formed

X-rays are created when extremely energetic electrons contact an anode and release energy in the form of photons, as we described previously. When these photons travel through materials, they are partially absorbed. The level of absorption varies depending on the kind of substance or material. Behind the region of interest is a cassette that contains a light-resistant material and an intensifying fluorescent screen.

The cassette is left behind when X-rays flow through the body through soft tissues like organs and muscles because these tissues cannot absorb the radiation. Big doses of radiation are administered to the patient, making the film appear black where they are present. In the body, rigid structures like bones allow X-rays to enter.

IV. UV-RAYS

A type of electromagnetic radiation called ultraviolet (UV) radiation is emitted by the sun and artificial sources like welding torches and tanning beds. The emission (sending out) of energy from any source is referred to as radiation. Radiation comes in a variety of forms, from very high-energy (high-frequency) radiation like x and gamma rays to very low-energy (low-frequency) radiation like radio waves. The middle of this spectrum is where UV rays fall. They have more energy than light that can be seen, but less than x-rays.

4.1 UV-Rays Sources

Even though UV rays only make up a small portion of the sun's rays, sunlight is the main source of UV radiation. The number of various UV light types that reach the earth varies. UVA rays make up about 95% of the sun's UV rays that reach the ground, with UVB rays making up the remaining 5%.

The strength of the UV rays reaching the ground depends on a number of factors, such as:

UV rays are most potent between the hours of 10 am and 4 pm. UV rays are more intense in the spring and summer months of the year. The equator is closer therefore this is less of an effect.

The amount of UV radiation decreases with increasing latitude (distance from the equator).

The altitude at greater altitudes, more UV radiation reaches the ground. Clouds: The impact of clouds can vary, but it's crucial to understand that UV rays can penetrate clouds and reach the ground.

UV rays can reflect off of several surfaces, including water, sand, snow, concrete, and even grass, increasing UV exposure.

Air constituents: Ozone, which filters away pollutants in the upper atmosphere,

4.2 UV-Rays

Sunlamps and sunbeds (tanning beds and booths): The quantity and nature of UV radiation that a person is exposed to from a tanning bed (or booth) varies on the particular lamps used in the bed, the length of time a person spends in the bed, and the number of times a person uses the bed. The majority of current UV tanning beds release UVA radiation, with the remainder being UVB rays.

UV light therapy, or phototherapy, is used to treat some skin conditions like psoriasis. A medication called psoralen is first administered as part of the PUVA therapy. The medication accumulates in the skin, increasing its UV sensitivity. After that, UVA radiation is used to treat the patient. Utilizing UVB alone is a different therapy approach (without a drug).

Black-light lamps: These light sources emit UV rays (mostly UVA). The bulb emits some visible light as well, but it contains a filter that lets the UV rays through while blocking the majority of it. These purple-hued bulbs are used to see fluorescent material. Bug-zapping insect traps also use "black light," which emits some UV rays, but the bulbs are blue instead of black because of a different filter.

Mercury-vapor lights: Mercury-vapor lamps are useful for lighting up spaces that are open to the public, like streets or gymnasiums. If they are functioning properly, they don't expose individuals to UV radiation. In reality, they are composed of two bulbs: an inner one that emits light and UV rays, and an exterior one that

filters out the UV. Only when the outer bulb is shattered can UV exposure occur. When the outer bulb fails, some mercury-vapor lamps are programmed to turn themselves off.

Plasma torches, high-pressure xenon and xenon-mercury arc lights, and welding arcs: For many purposes, including UV "curing" (of inks, coatings, etc.), disinfection, simulating sunlight (to test solar panels, for instance), and even in some car headlights, xenon and xenon-mercury arc lamps are used as sources of light and UV rays. In terms of workplace UV exposure, the majority of these, along with plasma torches and welding arcs, are of particular concern.

V. CONCLUSION

There are many uses for image processing, giving the researcher the choice to select one of his favourite fields. Although many research findings have been published, many areas of study remain unexplored. Additionally, digital image processing has emerged as the most popular type of image processing thanks to the quick computers and signal processors that were available in the 2000s. This is because it is not only the most flexible way, but also the most affordable.

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