

Thermogram and DFU

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Objective

- How Camera Captures Thermogram
- What is a Thermogram
- Significance Of Thermogram
- Difference Between an Healthy and Unhealthy Thermogram(DFU)

Capturing Thermogram (Camera)

- 1 A **Lens** on a thermal camera only allows for **Infrared Radiation** to pass through.

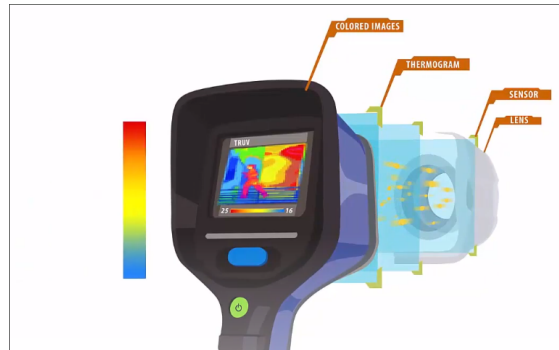


Figure 1: A Handheld Thermal Camera

Capturing Thermogram (Camera)

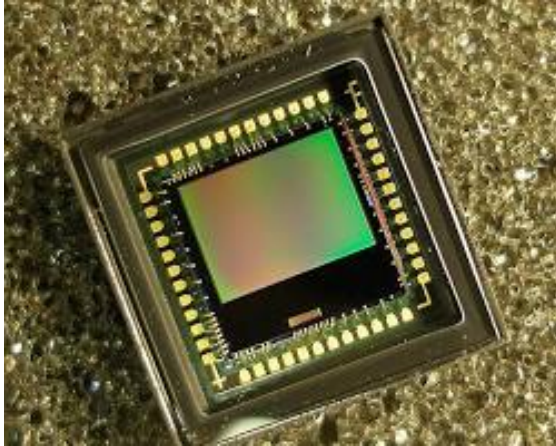


Figure 2: CMOS Camera Sensor

- ① It focuses it on a **Sensor** which is a grid of photo-sensitive cells(diode) which trigger a voltage when they detect Infrared.

Capturing Thermogram (Camera)

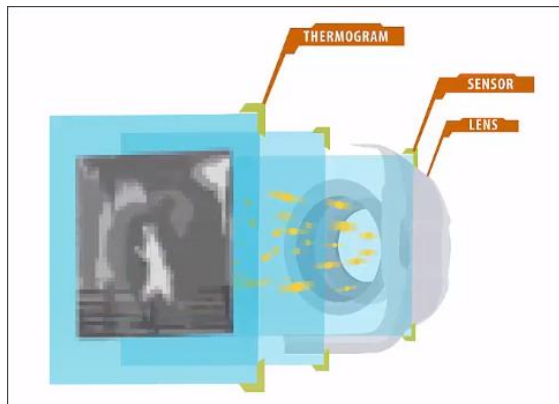


Figure 3: Thermogram

- 1 A computer in camera, interpret this as an digital signal and makes a texture (2D Array of Value) called **Thermogram** which has propotional temperature values.

Capturing Thermogram (Camera)

- ① This represented on the screen of that camera as a color image where different color region belongs to Either Hotter or colder area.
- Generally **Rainbow** Pallette is used where VIBGYOR → Colder to Hotter.

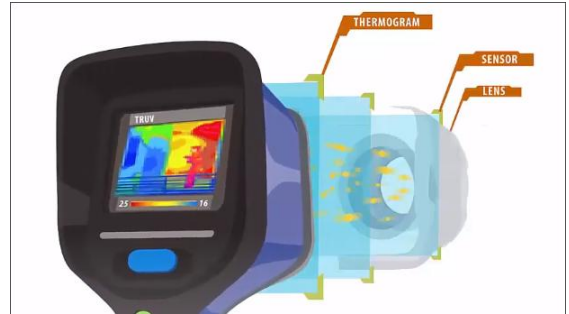


Figure 4: Color Image

Capturing Thermogram (Infrared)

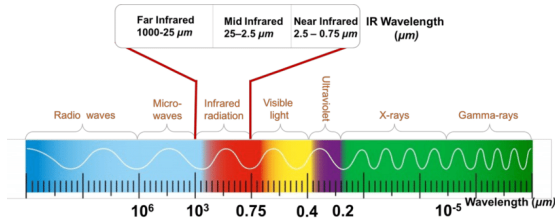


Figure 5: Electromagnetic Spectrum

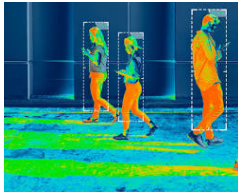


Figure 6: Thermogram

- A Thermal camera works in infrared region of an electromagnetic spectrum
- **Infrared Radiation** is a type of energy that is emitted by all objects with a temperature above **absolute zero**(0K)
- The amount of infrared radiation emitted by an object is proportional to its temperature

Thermogram

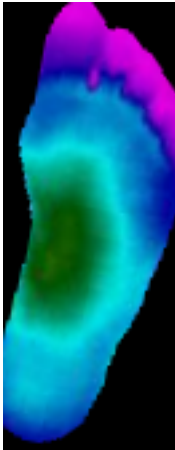


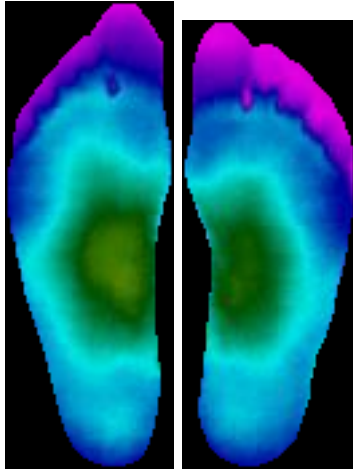
Figure 7: Thermogram Of Foot

- Thermograms are Images produced by *Thermal Imaging Cameras*
- They are a texture of temperature
- Usually a Thermogram is represented as a color image where different range of temperature maps to some color.
- For example Rainbow Palette in which VIBGYOR From Left to right assigned for Colder to Hotter Temperature

Significance Of Thermogram (DFU)

- ① Ability to Capture Temperature Variations → caused by poor blood circulation
- ② More information compared to normal images, therefore effective in early diagnosis

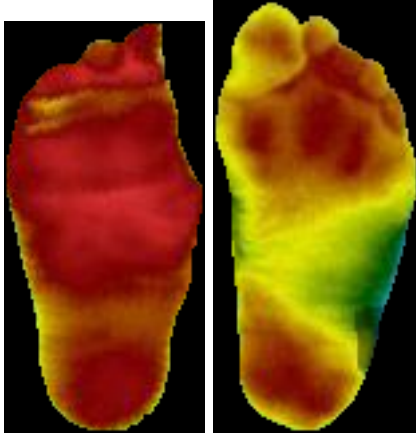
Healthy DFU Thermogram



Properties Of Healty Thermogram

- Symmetrical Temperature Distribution
- **Butterfly Pattern** In Middle Of Foot
 - Cooler in heel and toes
 - Warmer in Arch
- Colder compare to Infected foot

Diabetic Foot Thermogram



Properties Of Diabetic Thermogram

- Unsymmetrical Temperature Distribution
- Absence Of **Butterfly** Pattern
- Increased Overall temperature of thermogram