DAILY ASSESSMENT FORMAT

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Topic:	**Computer Vision Basics**	**Semester & Section:**	**6th sem 'B"**
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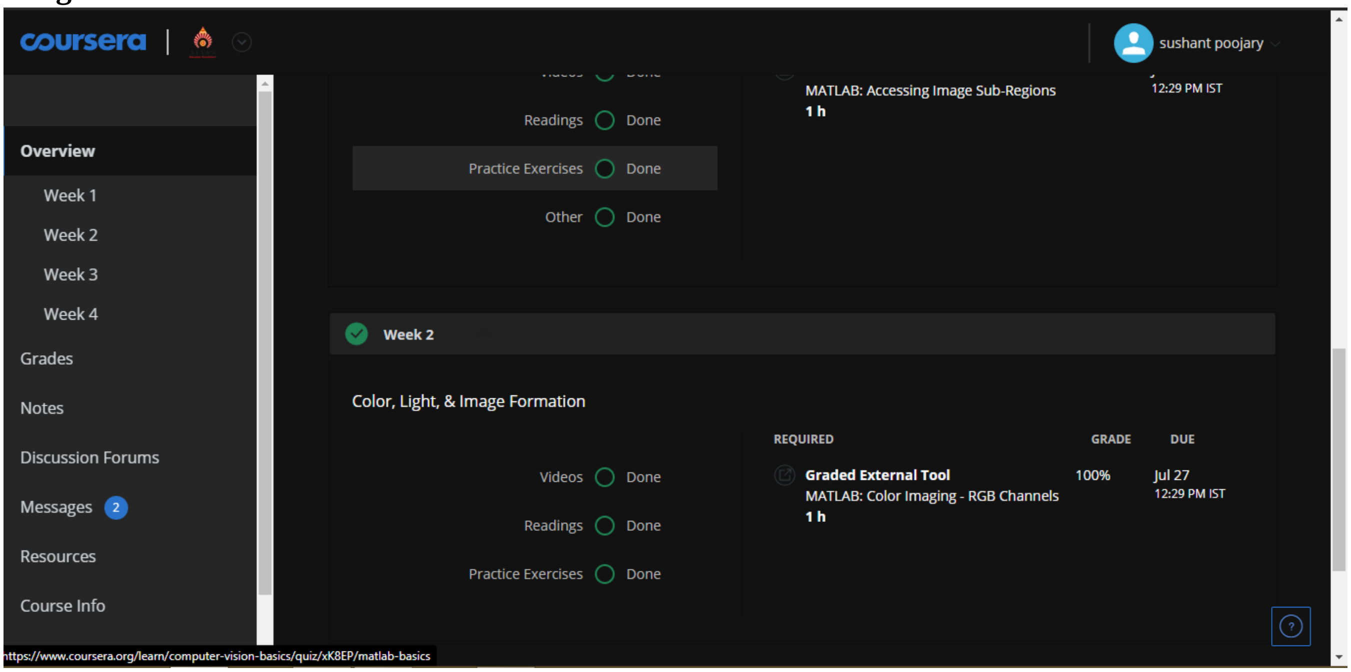
FORENOON SESSION DETAILS
Image of session



Report –

The visible spectrum occupies a very small part of the overall electromagnetic spectrum. In the course of evolution, our vision is optimized for receiving the dominant wavelengths are some emits. The retina of human eye has two types of photoreceptor, rods and cones. Rods are sensitive to light intensity while cones are color sensitive. When incoming light hits an imaging sensor, light from different parts of the spectrum is integrated into the discrete red, green, and blue color values that we see in the digital image. You probably recall from your childhood days the magical process of mixing paint colors to obtain blended new ones. For example, adding blue with yellow makes green. The additive primary colors red, green, and blue, can be mixed to make all the other colors in the color spectrum. Let us look at the color theory, and how it can be useful for computer vision applications in more detail. Different as we see it, is full of colored objects. Colors are an integral part of our visual perception, and often used for recognizing objects. Colors of nature have been an inspiration for art and artists throughout the history. But color is not a primary physical property. Color as we see it, is just a perception which depends on the physical properties of the objects and the light that illuminates them. So to understand color, we have to understand our own visual system. Our eyes consists of a region called the fovea, where the concentration of the photoreceptors is tense. Foveal vision refers to the centre of the field of vision where visual acuity is at its highest. That is why we tend to move our eyes when we're reading or while we're driving. The photoreceptors consists of rods and cones of which the cones are responsible for color perception. Cone cells can be classified into three categories based on the wavelengths they are more responsive to. The cone cells are labeled as L, M, S, which are responsive to red, green, and blue wavelengths respectively. The absence of a specific type of concepts is going to result in color blindness. This is the underlying principle behind the trichromatic theory proposed in the 19th century. The theory states any color in the visible spectrum can be replicated using just three primary colors. Trichromacy is the working principle of television and the screen that you're looking into right now. This also inspired the color photography in the early 20th century. If we were to replicate this in our digital cameras, we would need a mechanism which can split the incoming light into red, green, and blue channels, and project them on to their respective image sensors. But this is not how color images are captured in digital cameras. Digital cameras use color filter arrays, which differ from one camera to the other but the underlying principle is the same. They use at least three color filters to capture the color images. The incoming light is filtered only a set of wavelengths are allowed to hit those specific pixels on the image sensor. The obtained image is in raw format and it needs to be D mosaic to get the color image. The d mosaicing is done using interpolation techniques, and then we'll have the separate RGB color channels which finally constitute the color image. Each pixel location in an RGB color image contains three intensity values. Before we proceed any further, we have to understand the difference between additive mixing and subtractive mixing of colors. Additive mixing comes into action when we are dealing with light sources. When red, green, and blue colored lights are put together, we can recreate most of the colors in the visible spectrum, and that is the working principle of your television screen. Subtractive mixing comes into action when you're not dealing with the light sources. Rather you're dealing with colored pigments. Subtractive mixing is the working principle of printing industry where cyan, magenta yellow are used to create all the spectrum of colors that we see. In other words, replicating colors using active lite uses editor mixing and passive Lite uses subtractive mixing. Now to validate if three primary colors like RGB are sufficient for replicating any color in the visible spectrum. We can do that using this simple experiment. To the, left we have a monochromatic light source and to the right we have pure light sources which can emit RGB wavelengths. To match the color on the lef the observer is given an option to adjust the intensities of these three primary colors, and stop when an exact match is found. But this may not be the case for all the visible wavelengths. There could be a situation where no matter how much you edges the primary colors that you have to the your are never really able to match the color to the left. One way you can match these two is by adding some intensity of the primary color to the left. This is equivalent to having a negative value on the right. Here is how the matching function looks like when we tried to replicate every visible wavelength. With the RGB primary colors. The negative weights are undesirable which, pushes for a better primary color selection and new color spaces. Here is a Visualization of what exactly happens when we try to match monochromatic light with a mix of RGB color lights.

Now mixing two lights produces colors that lie along a straight line in color space. Mixing three lights producers colors that live within the triangle. They're defined in the color space. This is the basis of color spaces. Now here is a visualization of what colors of visible spectrum can be represented using RGB color space and CMYK color space.

To overcome the hurdle of the negative weight CIE color space is introduced in 931. Color spaces have also been defined to be perceptually meaningfulIike having hue saturation and value, which corresponds to HSV. We shall revisit the color spaces when we discuss the color image processing.

In this model, conceptually, all light passes through a vanishingly small pinhole placed at the origin and illuminates an image plane beneath it. The images formed on the image plane follow the laws of projective geometry. When using a pinhole camera model, this geometric mapping from 3D to 2D is called as perspective projection. Clearly, we are losing the depth dimension of the scene in these projected 2D images. Human vision evolves significantly to identify several cues from the 2D images to perceive depth from a single image. Perspective projection makes parallel lines in the real world appear that they might be converging.