

(Note: this exercise is available via 4 fixed questions on Wooclap, which are to be done asynchronously and then commented on the next class. Because I'm a good person and I like people to be organized upfront, here are the questions for you. Consider the quiz on Wooclap was closed up until the next day and she just told it at random without any kind of Moodle announcement)

Important: She says this counts as a homework which can possibly give you points and make you recover other homeworks not passed. So, I suggest you complete it.

1. *Why isn't CMY suitable for printers?*

Observations:

CMYK is subtractive model, given it absorbs the light and the element is black. Instead, RGB adds color because it projects to the maximum level of luminosity all of the colors (so, red to the max level, green to the max level, etc.).

Using this model to get a black surface we have to prevent it from reflecting all the primaries (red, green, and blue), so we have to color it cyan, magenta, and yellow at maximum intensity. Using the maximum amount of ink of all the three components allows to obtain black in printing.

Theoretically mixing the primary colors C,M,Y should result in black. In reality, however, this does not happen because of impurities in the ink pigments. For this reason it is also necessary to introduce the component K.

Answer (Claude.ai):

CMY is not suitable for printers because the impurities in the cyan, magenta, and yellow ink pigments prevent them from producing a true, deep black when mixed together. Instead, the result is often a muddy, dark brown color (also, it's too costly to actually do that). The addition of a separate black ink (K) in the CMYK color model overcomes this limitation and allows for the production of high-quality black and grayscale prints. The other colors do not absorb light very well.

Actual answer:

All of the colors represent a different level of luminosity. In order to actually obtain black, we should represent all of the color components to their maximum level of luminosity. Because of impurities, we do not actually encode them completely, hence obtaining a muddy brown color (other colors do not absorb light very well). Hence, the addition of a separate black ink (K) in the CMYK color model overcomes this limitation

Answer

It's quite impossible to have a good/perfect black with CMY, so putting the exact drop of color of each one it's very hard. Since we want to use black, we need it as one of the colors. The second reason is that it costs a lot.

2. *Why do YUV, YIV and YCbCr color models use blue and red chrominance and not green chrominance?*

Observations:

Cb and Cr respectively represent the blue-difference and red-difference chroma signals as you noted. Chromaticity represents the perceptual deviation from the neutral, i.e. grayscale, so the greater the deviation, the higher the intensity of chroma. An image with low chroma is less colorful, and conversely. And so, Cb and Cr are one representation of changes in blue and red "colorfulness", respectively.

They have a channel for luminance and two channels for chrominance. They decided to use red and blue, to avoid wasting one channel. One was used only for black/white TV (Y), which is what we perceive as luminosity by rods. The information about green is very similar to the one of luminance and half of this information is exactly.

The YUV, YIQ, and YCbCr color models use blue and red chrominance channels because they are designed to separate luminance (brightness) information from chrominance (color) information.

Answer (Claude.ai):

The YUV, YIQ, and YCbCr color models use blue and red chrominance channels (Cb and Cr) instead of a green chrominance channel because the luminance channel (Y) already captures most of the green information.

The visual system is most sensitive to green light, which contributes significantly to the perceived brightness of an image. By designing the luminance channel to closely correspond to the green channel, these color models can efficiently represent brightness information without the need for a separate green chrominance channel.

This approach reduces redundancy and allows for more efficient compression and transmission of video signals while prioritizing the preservation of brightness information to which the human visual system is most sensitive.

Actual answer:

The models by themselves use blue and red chrominance respectively, which represent most of the luminosity information, represented by the always present component (Y). Such component is already able to capture most of the green information; using another channel (4 instead of 3) represents an improvement of space usage and performance

Answer

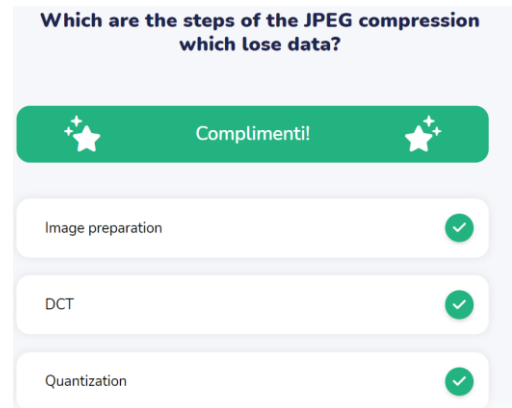
If you look at the slide, our rods have the same sensibility for green when having blue or red. The luminance is represented by the green color. If I use green + other colors, in the first part of the spectrum I have twice the information of the luminance and we do not need it.

3. Which are the steps of the JPEG compression which lose data?

- a. Image preparation
- b. DCT
- c. Quantization
- d. Matrix linearization
- e. Huffman and Zero Encoding

Answer:

- Quantization
- DCT
- Image preparation
 - o When we move to color models
 - o and we subsample the chrominance (losing at least half of the data)

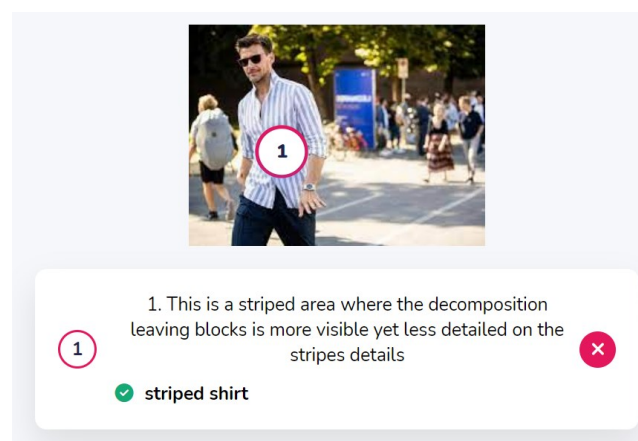


4. Identify areas of the image that can be complicated for JPEG compression

- a. You have to fill in the labels



Actual answer:



(Given the problem above for the exercise, the last question apparently changed and even the other questions seem unanswered even if you did; particularly, the last one changed here)

5. *Provide an example of image for which JPEG is not the correct choice*

Actual answer:

- Simple images with high contrast (even in black or white)
- Artificial images
- Images with transparency
- Line art and drawings
- Images with very high degree of detail e.g. medical/satellite images (JPEG2000 works better)

Answer:

- Solid colors with elements of high contrast
- Medical images
- Satellite images
- Artificial images