* **Colour Spaces** are the references of the **visible spectrum** with respect to which the colour representation of a pixel is determined, it is the set of colours which can be **representable/reproducible** on a given **device/medium** from its colour model, i.e., the colour **capability and retainability** of a **device** and/or a **digital file**.
* ***List of some common Colour Spaces***:
  + **sRGB (RGB model)**
    - **Advantages**: most of the devices can reproduce sRGB colours, same output on all(most) of the devices, easier(simple) to perform image processing on.
    - **Disadvantages**: limited range of colours, less saturation, image quality are diminished, can’t convert to other(higher) colour spaces.
    - **Uses and Applications**: Video Games, Web Applications, Image processing involving less emphasis on visual quality for faster processing.
  + **AdobeRGB (RGB model)**
    - **Advantages**: Compatible with CMY printers, better image quality, wider colour tone range, ideal colour space for printing to hardcopy, convertible to sRGB.
    - **Disadvantages**: Results in unnatural colour if used in Web Applications, not compatible for all devices, higher cost for compatible devices
    - **Uses and Applications**: Used in photography competitions, use in physical printing of image, image processing/displaying involving emphasis on visual quality.
  + **Rec.709 (RGB model)**
    - **Advantages**: Standard for image encoding and distribution, most of the devices can reproduce Rec.709 colours, faster image processing and thus streaming friendly.
    - **Disadvantages**: limited (but slightly higher than sRGB) range of colours, can’t convert to other(higher) colour spaces.
    - **Uses and Applications**: Standard for HD Tv screens, Streaming services like YouTube, Video encoding and transmission online.
  + **Rec.2020 (RGB model)**
    - **Advantages**: Standard for UHD, 4k, 8k screens, has high peek luminance, High quality images, wide range of colour tones.
    - **Disadvantages**: Requires specific devices to reproduce the colours (but no device can reproduce the entire colour space), high load on image processing, less to none support for application other than playing videos with high resolution images.
    - **Uses and Applications**: Used in UHD-4k-8k Tv screens, playing high quality movies.
  + **YCbCr and YUV (YUV model)**
    - **Advantages**: Ideal for image compressions, uses less bandwidth(data) to encode similar colour info and still retain the colour reproducibility, easy image processing involving changing/preserving detecting luma(brightness) (involves a single variable to process).
    - **Disadvantages**: Abstract concept (humans can’t predict the colour just by seeing the values unlike RGB) and requires processing to reproduce images.
    - **Uses and Applications**: Digital/Cable broadcasting, video/image compression.
  + **HSV and HSL (HSB model**)
    - **Advantages**: easy image processing involving changing/preserving/detecting chroma (colour component) or luma(brightness) (involves a single variable to process), easy converting to different colour model (/colour spaces), easy/natural for humans to understand the concept and create/manipulate logics.
    - **Disadvantages**: “Do not effectively separate colour into their three value components according to human perception of colour” ([HSL and HSV - Wikipedia](https://en.wikipedia.org/wiki/HSL_and_HSV)) (I honestly don’t understand this)
    - **Uses and Applications**: Object detection, face recognition, vision-based image processing.
  + **CMY and CMYK (CMY model)**
    - **Advantages**: Uses subtractive colour model (pigments) and thus is directly compatible with printing to hardcopy, very easy conversion to RGB colour model thus suitable for digital screens also. CYMK colour space has added benefits of key (black, darkness) components making it more suitable for physical printing or processing involving physical components.
    - **Disadvantages**: Harder for humans to understand the concept than RGB
    - **Uses and Applications**: Printing on physical hardcopies, processing involving any physical components like pigments, chemicals etc.
* ***HSV and HSL (HSB model) is the best colour space for target detection on green grass***:
  + Can process a single variable Hue to determine the chroma (pure colour component) of a pixel/group of pixels and thus detect objects other than green on the image
  + Can process a single variable saturation to detect colour tone changes within the same Hue chroma and thus detect objects of the same green colour on the image with green background (green grass)
  + Can process a single variable Brightness/Value/Luma to determine shadows, edges, faces of objects from case 1 and case 2.
  + Combining all 3-variable processing an accurate object detection logic is plausible with an easier and clear abstraction.