Colour Spaces

Dr Frazer Noble

Introduction

In this presentation, I will describe:

- How to use OpenCV to convert colour spaces.

Requirements

To follow along with this tutorial, you will need the following tools:

- Python 3.8.6.
- Visual Studio Code 1.53.1.

You will also need to install the following Python packages:

- OpenCV.
- NumPy.

It is assumed that you are using Windows; however, these instructions should be easily adapted to Linux.

Getting Started

Open Visual Studio Code. To open the app: Open the Start menu, type `Visual Studio Code`, and then select the app.

Open the Explorer tab. To display the tab: Left click `View > Explorer` or press `Ctrl` + `Shift` + `E`. This will display the Explorer tab.

Left click on the `Open Folder` button. This will display the Open Folder prompt. Browse to the following directory:

```
C:/Users/%USER%/Documents
```

Note: Replace `%USER%` with your own username. My username is fknoble; hence, the path is `C:/Users/fknoble/Documents`.

In `C:/Users/%USER%/Documents` create a new folder named `opencv_08`. To create a new folder: Right click in the Explorer tab, left click `New Folder`, and rename it.

In `C:/Users/%USER%/Documents/opencv_08` create a new folder named `data`. Download `apples.PNG` from here; save it in `C:/Users/%USER%/Documents/opencv_08/data`.

In `C:/Users/%USER%/Documents/opencv_08` create a new file named `hsv.py`. To create a new file: Right click on `/opencv_08` in the Explorer tab, left click `New File`, and rename it. The file will open automatically.

`/opencv_08` should contain the following files and folders:

```
/opencv_08
    /data
        apples.PNG
    hsv.py
```

`hsv.py`

Type the following code into `hsv.py`:

```
import cv2 as cv
import numpy as np
```

OpenCV's Python module `cv2` is imported as `cv` and NumPy's Python module `numpy` is imported as `np`.

Type the following code into `hsv.py`:

```
def main():

    img = cv.imread('data/apples.PNG')

    if img is None:
        print('ERROR::CV::Could not read image.')
        return 1
```

This begins `main()`'s definition. `imread()` reads an image from a directory and assigns the results to array `img`. If the array is empty, a message is displayed and `main()` returns 1.

Type the following code into `hsv.py`:

```
    rows, cols, channels = img.shape

    rows = rows // 2
    cols = cols // 2

    img = cv.resize(img, (cols, rows))

    cv.imshow('img', img)
    cv.waitKey(1)
```

`img`'s shape is assigned to integers `rows`, `cols`, and `channels`. `rows` and `cols` are divided by 2 (rounded down) and the results assigned to themselves. `resize()` resizes `img` to shape `cols` x `rows` and the result is assigned to itself. The array is then displayed in the `img` window.

Figure: The `img` array.

Type the following code into `hsv.py`:

```
    hsv_img = cv.cvtColor(img, cv.COLOR_BGR2HSV)

    cv.imshow("HSV", hsv_img)
    cv.waitKey(1)
    cv.imwrite("data/hsv.PNG", hsv_img)

    H = hsv_img[:, :, 0]
    S = hsv_img[:, :, 1]
    V = hsv_img[:, :, 2]
```

`cvtColor()` converts `img`'s colour space from BGR to HSV and assigns the results to array `hsv_img`. The array is displayed in the `HSV` window and saved as `hsv.PNG` in `/data`. The hue, saturation, and value channels are extracted from `hsv_img` and assigned to arrays `H`, `S`, and `V`.

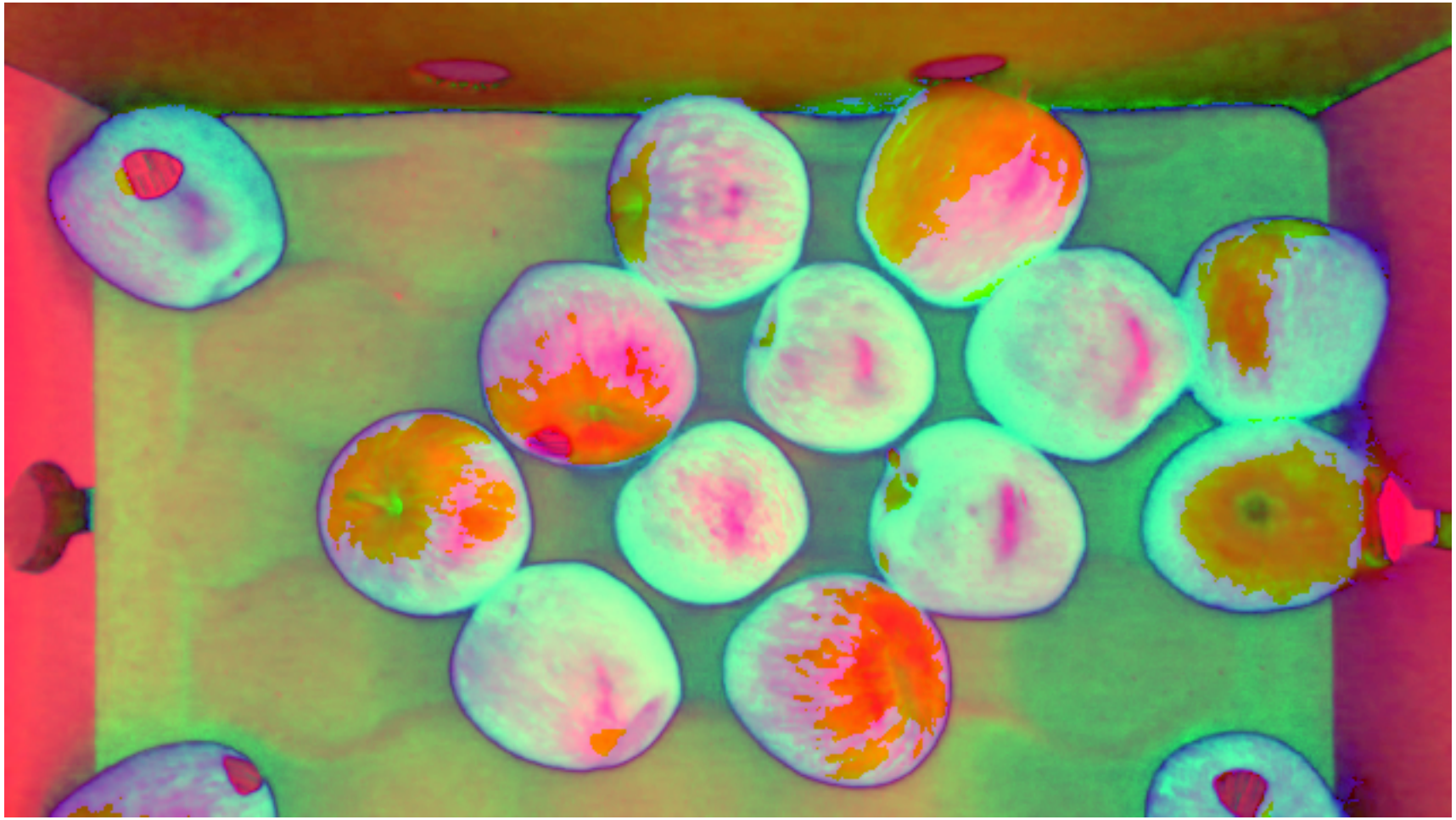

Figure: The `hsv_img` array.

Type the following code into `hsv.py`:

```
    cv.imshow("H", H)
    cv.waitKey(1)
    cv.imwrite("data/hsv_H.PNG", H)

    cv.imshow("S", S)
    cv.waitKey(1)
    cv.imwrite("data/hsv_S.PNG", S)

    cv.imshow("V", V)
    cv.waitKey(0)
    cv.imwrite("data/hsv_V.PNG", V)
```

`H` is displayed in the `H` window and saved as `hsv_H.PNG` in `/data`. `S` is displayed in the `S` window and saved as `hsv_S.PNG` in `/data`. `V` is displayed in the `V` window and saved as `hsv_V.PNG` in `/data`.

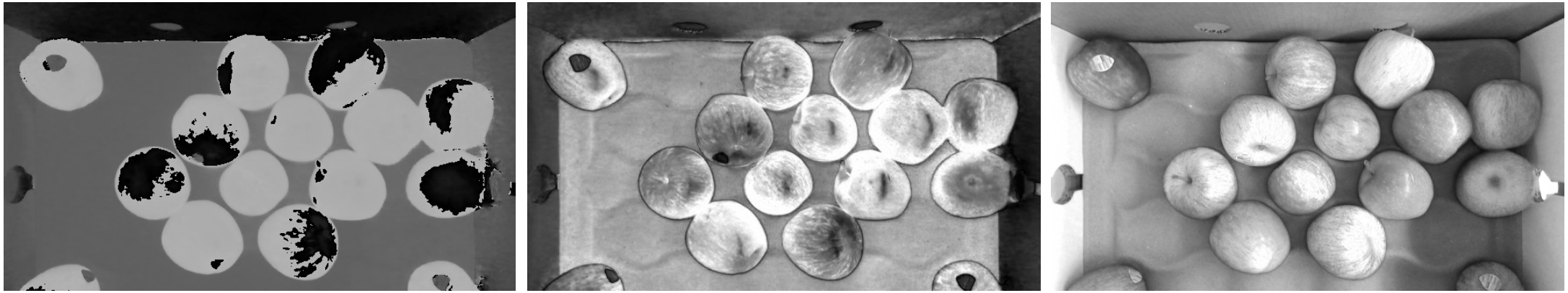

Figure: (Left) The `H` array; (Middle) the `S` array; and (Right) the `V` array.

Type the following code into `hsv.py`:

```
if __name__ == '__main__':

    main()
```

`main()` will be called when the `hsv.py` is run.

Run `hsv.py`

Open a new terminal in Visual Studio Code. To open a new terminal: Left click `View > Terminal` or press `Ctrl`+`` ` ``.

Type the following commands into the terminal and then press `Enter` after each one:

```
cd ./opencv_08
python hsv.py
```

This will change the current directory to the `/opencv_08` sub-directory and then run `hsv.py`.

Press any key to close the windows and stop `hsv.py`.

Conclusion

In this presentation, I have described:

- How to use OpenCV to convert colour spaces.

References

1. https://docs.opencv.org/.