Image is a matrix of pixel values representing various intensity level values. A pixel is the building block of an image. The gradient can be defined as the change in the direction of the intensity level of an image. And  the gradient helps us measure how the image changes and based on sharp changes in the intensity levels; it detects the presence of an edge.  (<https://www.analyticsvidhya.com/blog/2022/07/beginners-guide-to-image-gradient/>)

Positive values in the gradient = color is getting lighter

Negative values in the gradient = is getting darker.

Derivative Image in X-direction / second subplot

* Represents horizontal change in intensity.
* When we look black line-\*\*(negative values in the gradient)\*\* in the image we can say that image getting darker left to right suddenly. (125,125) until (125,175) which indicates pixel values decreasing.
* When positive values considered at (175,125) to (175,175) (White line) we can say that color is getting lighter suddenly.

Derivative Image in Y-direction / third subplot

* Represents vertical change in intensity.
* When we look black line in the image we can say that image getting darker and pixel values decreasing suddenly at y=125 until y=175 (as we go to bottom).
* When positive values considered at (y=175) (White line) we can say that color is getting lighter suddenly.

Simply:

When we checked both second subplot and third plot, we can see 4 lines (2 black, 2 white). Those lines indicate the sudden changes in the gradient intensity which is so obvious because we drawn a black square on a white background. Therefore, we can see sudden change x-axis coordinates from 125 to 175 and y-axis coordinates from 125 to 175 which is the boundries of the square and has abrupt change in color.

In conclusion positive values in the gradient shows color is getting lighter while negative values in the gradient shows is getting darker.

The second and third subplots of the gradient images reveal four lines (two black, two white) indicating sudden changes in gradient intensity. This is because the image depicts a black square on a white background. Therefore, sharp changes in the x-axis (125 to 175) and y-axis (125 to 175) coordinates are visible at the square's boundaries due to the abrupt change in color.

In conclusion positive values in the gradient shows color is getting lighter while negative values in the gradient shows is getting darker. Large gradient values are observed due to the high contrast between black and white pixels.