⑥ Deep Shap on Image

I/p : Take Grayscale Image of size 2 x 2 pixels,
1 channel (Grayscale)
flatten it → I/p vector → 4 pixels.

o/p → probability of a class.

Model → simple NN (only one densenet).

x (Input Image) (we have to explain this).

Pixel	Values
P_1	100
P_2	150
P_3	200
P_4	50

$x = [100 \quad 150 \quad 200 \quad 50]$

Background Sample (2 reference Image)

Pixels	Background 1	Background 2
P_1	50	100
P_2	50	100
P_3	50	100
P_4	50	100

I Background average for each pixel.

$$P_1 = \frac{50+100}{2} = 75$$

$$P_2 = \frac{50+100}{2} = 75$$

$$P_3 = \frac{50+100}{2} = 75$$

$$P_4 = \frac{50+100}{2} = 75$$

Simplified Model : Dense layer.

weights applied to each pixel

$w_1 = 0.01$ $w_2 = 0.02$ $w_3 = 0.03$ $w_4 = 0.01$

bias = 0 (for simplification)

II Model o/p for I/p

$$o/p = w_1 * P_1 + w_2 * P_2 + w_3 * P_3 + w_4 * P_4$$

$$= 0.01 * 100 + 0.02 * 150 + 0.03 * 200 + 0.01 * 50$$

$$= 1.0 + 3 + 6 + 0.5 = 10.5$$

$$o/p = 10.5$$

iii Take background sample 1 (50, 50, 50, 50)

o/p = 0.01 * 50 + 0.02 * 50 + 0.03 * 50 + 0.01 * 50

= 0.5 + 1.0 + 1.5 + 0.5

= 3.5

Take background sample 2 (100, 100, 100, 100)

o/p = 0.01 * 100 + 0.02 * 100 + 0.03 * 100 + 0.01 * 100

= 1 + 2 + 3 + 1 = 7

Basevalue of Background = $\frac{7 + 3.5}{2}$ = 5.25

II shap value calculation for each pixel:

P1 I/p = 100 Background = 75 avg

Difference = 100 − 75 = 25

weight = 0.01

Shap Value = 25 x 0.01

= 0.25

P2 I/p = 150 Background = 75 avg Diff = 150 − 75 = 75

weight = 0.02

= 0.02 * 75 = 1.5

P3

I/p = 200 Background avg = 75 Diff = 200 - 75 = 125

weight = 0.03

= 125 x 0.03 = 3.75

P4

I/p = 50 background avg = 75 Diff = 50 - 75 = -25

weight = 0.01

= -25 * 0.01 = -0.25

Shapely Value Summary

P1	0.25	light red
P2	1.50	strong red.
P3	3.75 (contributal Have.)	Very strong red.
P4	-0.25	light blue.

To verify Model o/p = Base Value of Background + Shap Value of pixel.

10.5 = 5.25 + 0.25 + 1.50 + 3.75 - 0.25

10.5 = 10.5