**Matlab Report – Assessed Practical Two**

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**Experiment One & Two Results**

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| **WM Image** | **Diff Image** | **PSNR** |
|  |  | 34.998626671151726 |
|  |  | 21.364988773544837 |
|  |  | 17.222651953011310 |
|  |  | 20.065085466010180 |
|  |  | 21.702289108520525 |
|  |  | 24.815601753943370 |

**Experiment One & Two Conclusions/Analysis**

Initially we should compare the impact of alpha on fidelity, we can see clear progression from images one to three, it is clear that the higher the strength (alpha) the more fidelity is impacted and in turn leads to lines appearing on the image more prominently. To quantify this we can use the PSNR value, we can clearly see that the PSNR decrease correlates with the alpha being raised in each of the image three images. A lower PSNR means that the test image is more different than the original, so a greater alpha reduces the fidelity. This further highlights the balance required of robustness and fidelity, it is crucial to keep the watermark secure while not altering the integrity of the original image according to the human visual system. The position is also a constant in this set which reinforces the previous point.

The next three images take a different approach, modifying the position while keeping the alpha at a constant 0.5 value, from this we can extract further information. It is clear that the PSNR increases as the position increases and in the image itself we have a much greater level of fidelity as the embedder after embedding when the position is greater. If we manually inspect the difference images for the second set of three (where the position is varied) we can see the embedded content isn’t as blocky and more spread out. This is because the embedder has much more pixels to manipulate, which allows the watermark to be spread across a larger area and getting closer to the most spectrally significant components, reducing distortion and increasing fidelity. If I increased the position even further, I would expect an even greater level of fidelity, so in a production system it would be wise to set the position to the width of the image.

NOTE: experiment three results on the next page

**Experiment Three Results**

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| --- | --- |
| **Similarity array original WM** | **Similarity array Different WM** |
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**Experiment Three Conclusions**

To perform this analysis we must consider how detection works in Spread Spectrum Watermarking, the similarity array should have a significant spike in the watermarks chosen position, in this case ‘250’. This point is reinforced when all the original watermarked images are considered, with clear spikes where the watermarked is embedded, showing a successful detection. In the original three images were only the alpha changes, a pattern emerges, the higher the strength the lower the peak of the watermark becomes, if you refer to the image were alpha = 1 and compare to the previous values this becomes clear. A similar phenomenon occurs when the alpha is constant and the position is increased. We can also see that increases to the position makes the detector much more concentrated and makes the watermark easier to distinguish.

Considering the second column of images which represent a new watermark being applied in place of the original watermark in the similarity measure. This function tries to detect the watermark however the swap has made this impossible, as we can see at position 250 it blends together with the rest of the surrounding points in the graph, we can see that the alpha or position has no effect on this set of six manipulated watermarks with the graph being fairly random.

In summary these sets of images show how a correlation coefficient can be utilised to detect a watermark in an image by plotting the array into a graph, we have also examined the effect of position and alpha on this process.