Matlab Scripts for Image Processing Filters (2)

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Description of files:

1. Filename: edgeDetect_colourImages.m

   Finds edges in a colour image, using values of red, green and blue channels

2. Filename: edgeDetect_blackAndWhite.m

   Finds edges in a black-and-white (greyscale) image. If the image is a RGB image, it selects the red channel values to detect the edges.

Filter used:

$$Y(m,n) = \sum_k \sum_l k\, e^{-\alpha|k|}\ (1 + \alpha\,|l|\,)\, e^{-\alpha|l|}\ \ I(m-k, n-l)$$

Recursive versions that are used:

Smoothing in 1D:

$$Y_{1-}(n) = S_1\, I(n) - S_1\, e^{-\alpha}(\alpha - 1)\, I(n-1) + 2e^{-\alpha}\, Y_{1-}(n-1) - e^{-2\alpha}\, Y_{1-}(n-2)$$

$$Y_{1+}(n) = S_1\, I(n) - S_1\, e^{-\alpha}(\alpha - 1)\, I(n+1) + 2e^{-\alpha}\, Y_{1+}(n+1) - e^{-2\alpha}\, Y_{1+}(n+2)$$

$$Y_1(n) = Y_{1-}(n) + Y_{1+}(n) - S_1\, I(n)$$

$$S_1 = \frac{(1 - e^{-\alpha})^2}{1 + 2\alpha e^{-\alpha} - e^{-2\alpha}}$$

Anti symmetric filter in 1D:

$$Y_{2-}(n) = S_2\, e^{-\alpha}\, I(n-1) + 2e^{-\alpha}\, Y_{1-}(n-1) - e^{-2\alpha}\, Y_{2-}(n-2)$$

$$Y_{2+}(n) = S_2\, e^{-\alpha}\, I(n+1) + 2e^{-\alpha}\, Y_{2+}(n+1) - e^{-2\alpha}\, Y_{2+}(n+2)$$

$$Y_2(n) = Y_{2-}(n) - Y_{2+}(n)$$

$$S_2 = \frac{(1 - e^{-\alpha})^2}{e^{-\alpha}}$$

A set of 4 images, their sizes, output edges, and the execution times are shown in the following pages.

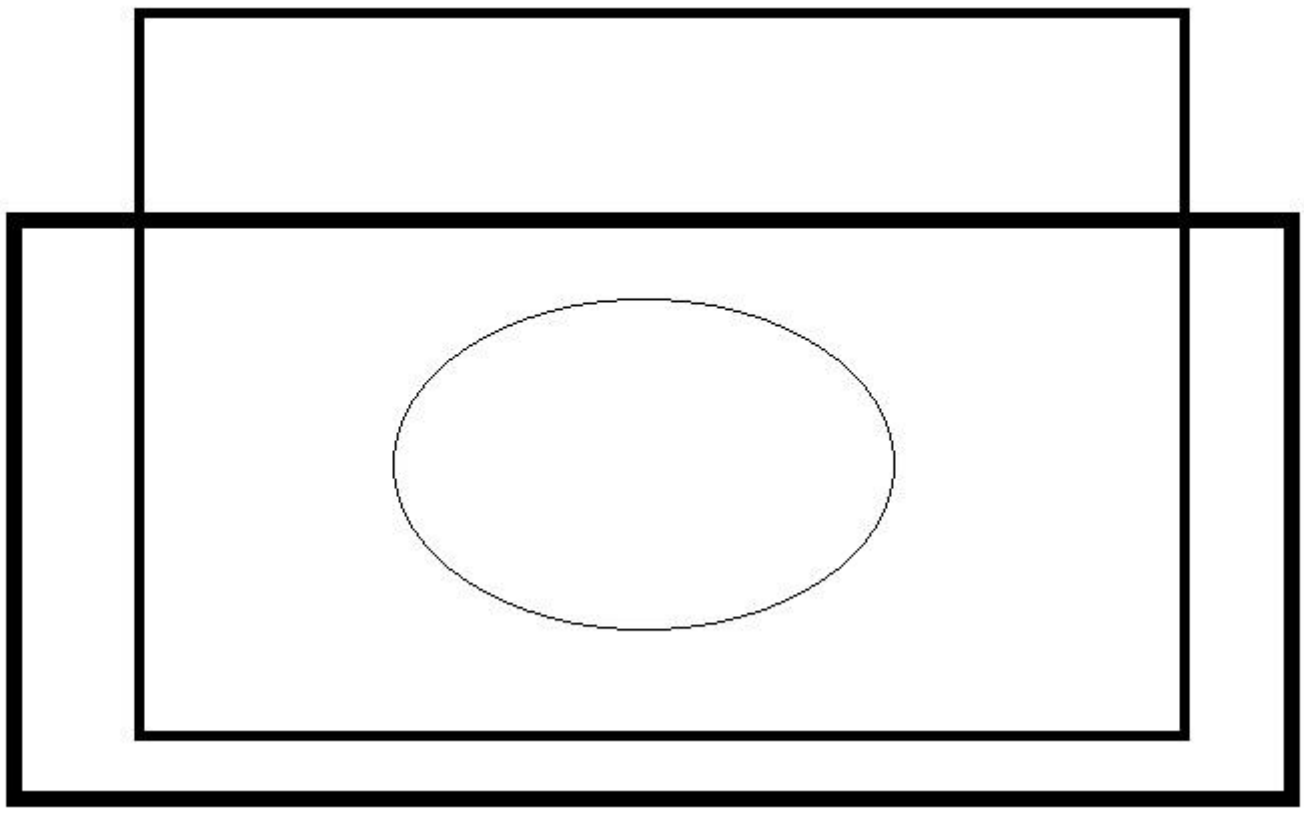

Figure 1: Original Image 1. Size 783 x 443

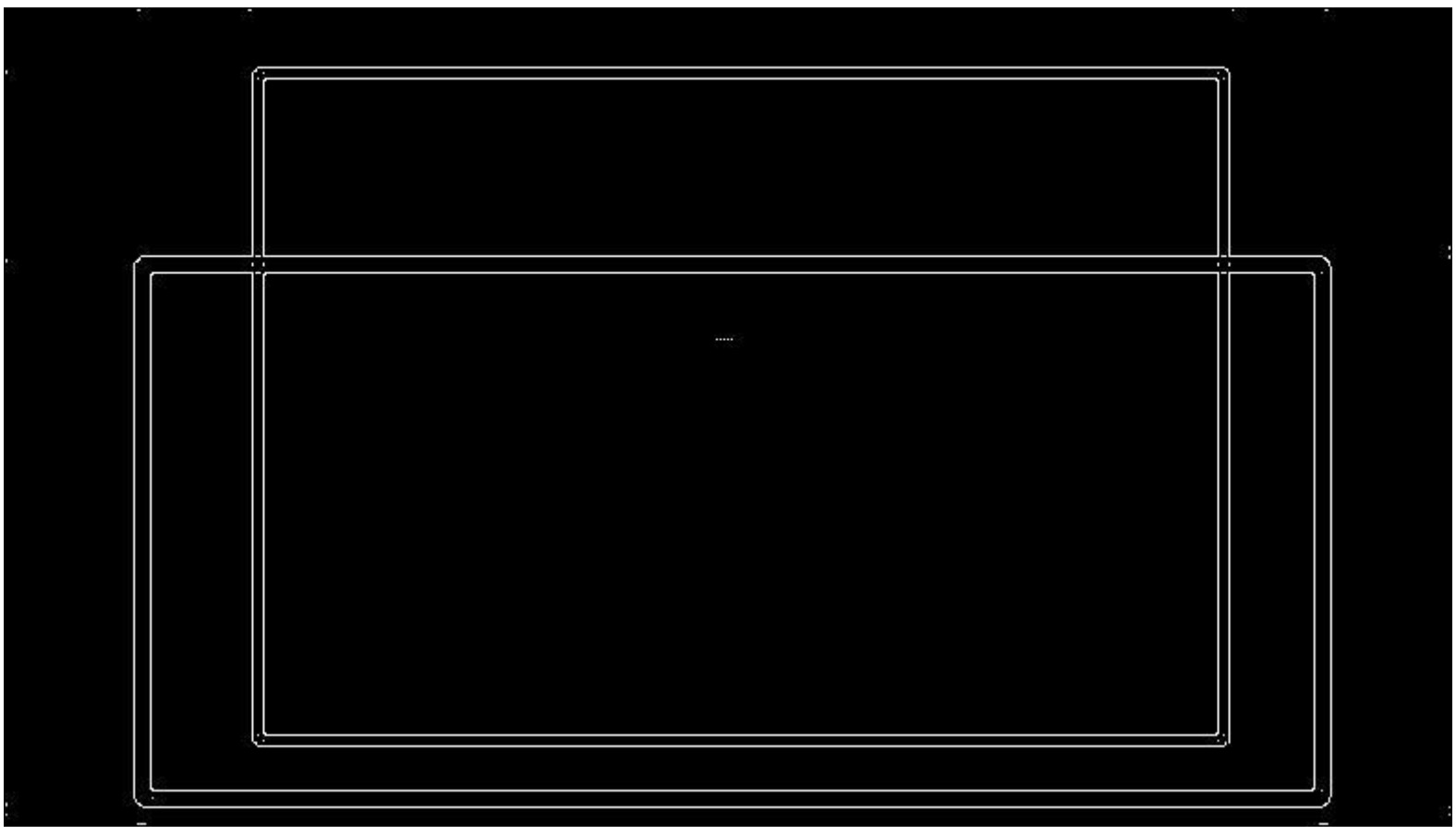

Figure 2: $\alpha = 0.5$. Execution time: 13.9 sec

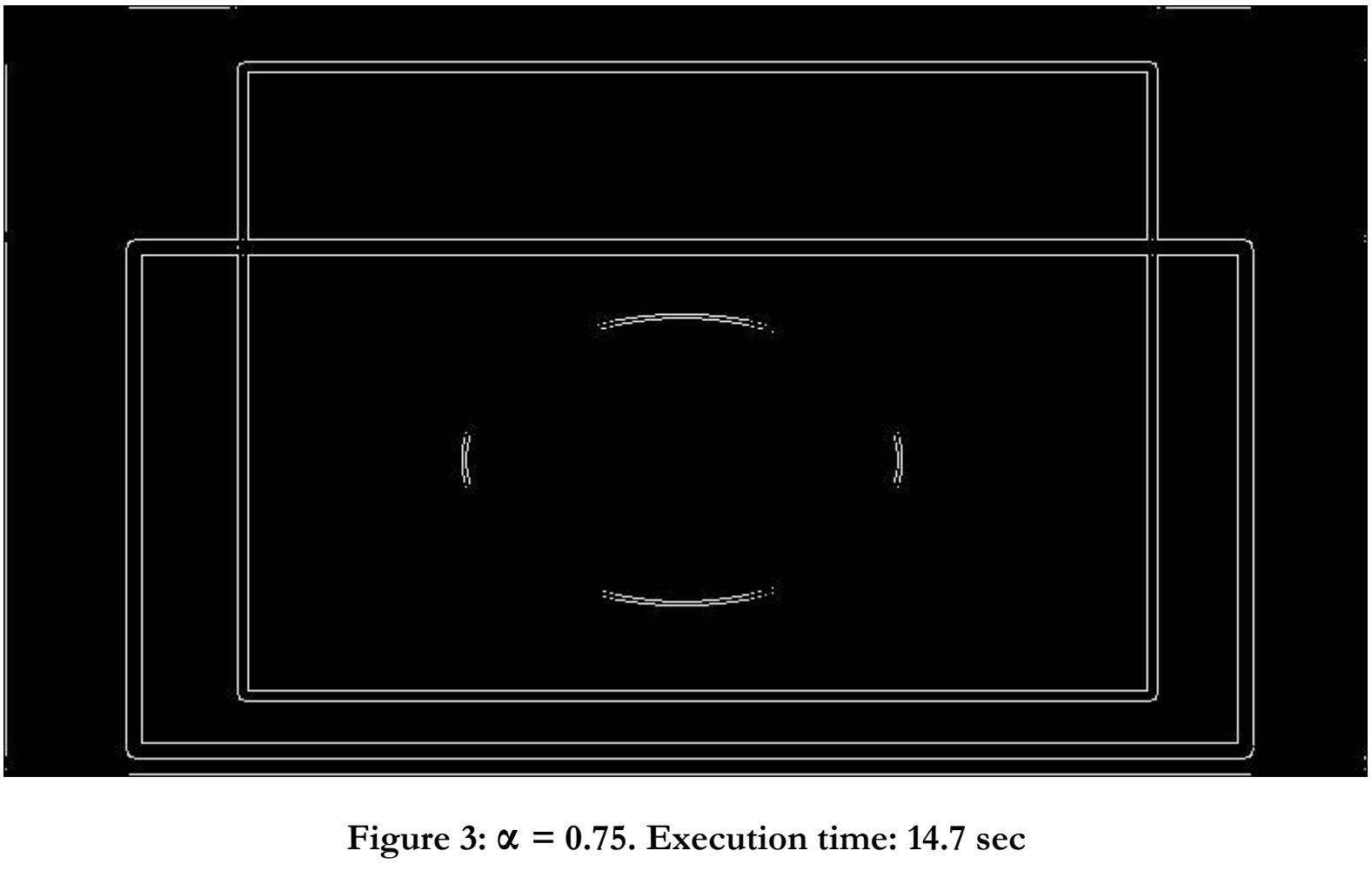

Figure 3: $\alpha = 0.75$. Execution time: 14.7 sec

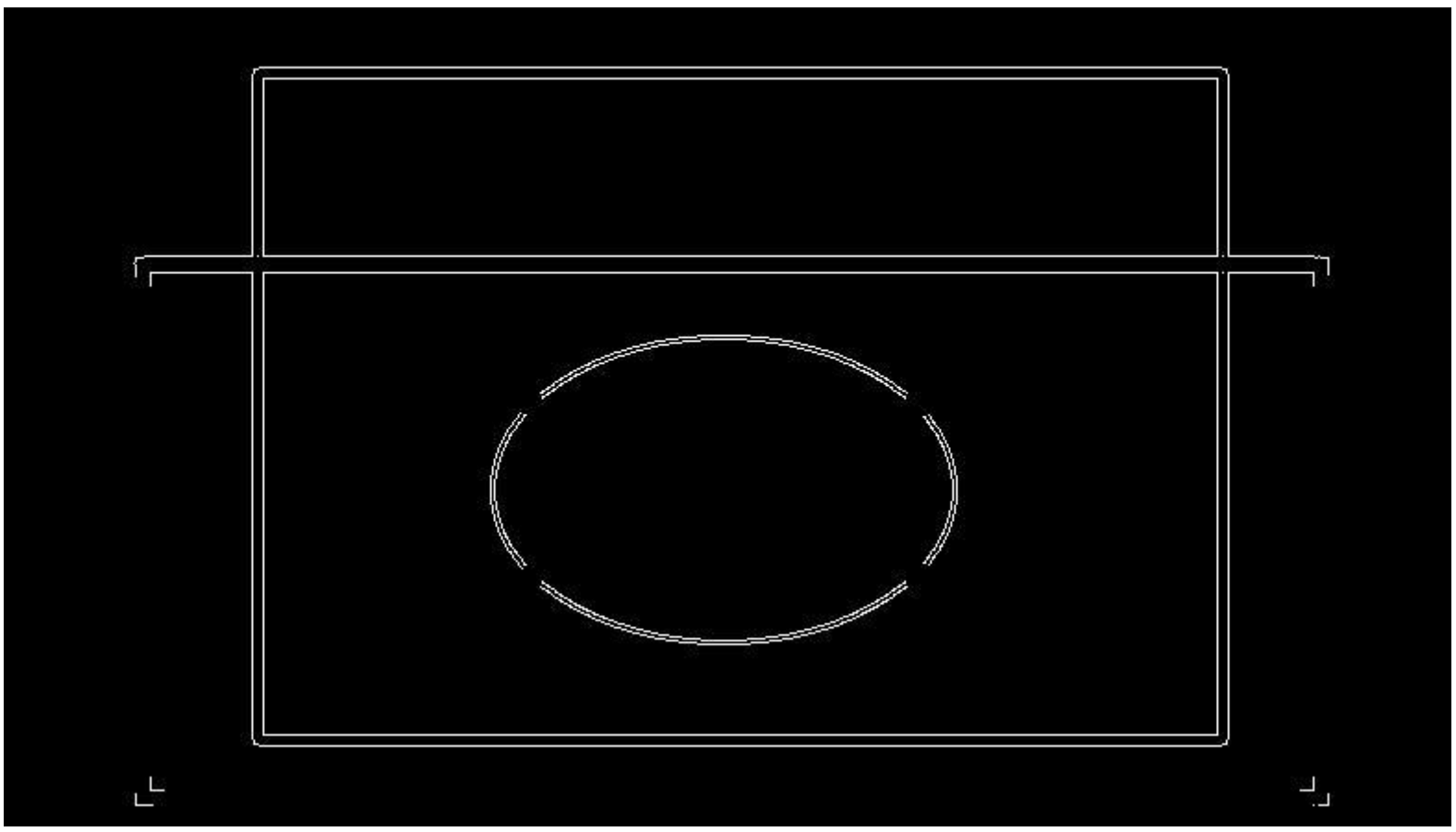

Figure 4: $\alpha = 1$. Execution time: 15.3 sec

Image 2

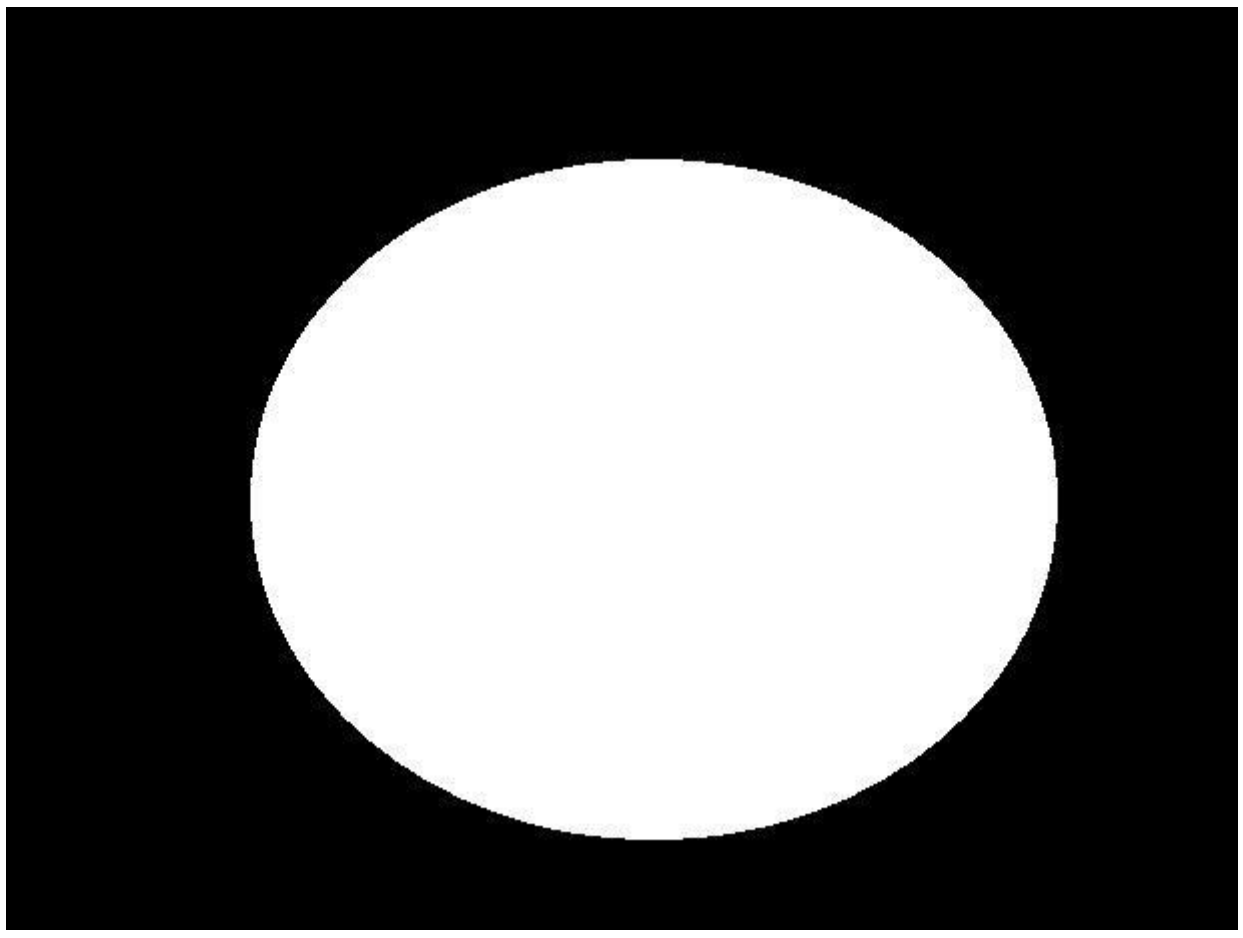

Figure 5: Original Image 2. Size 615 x 461

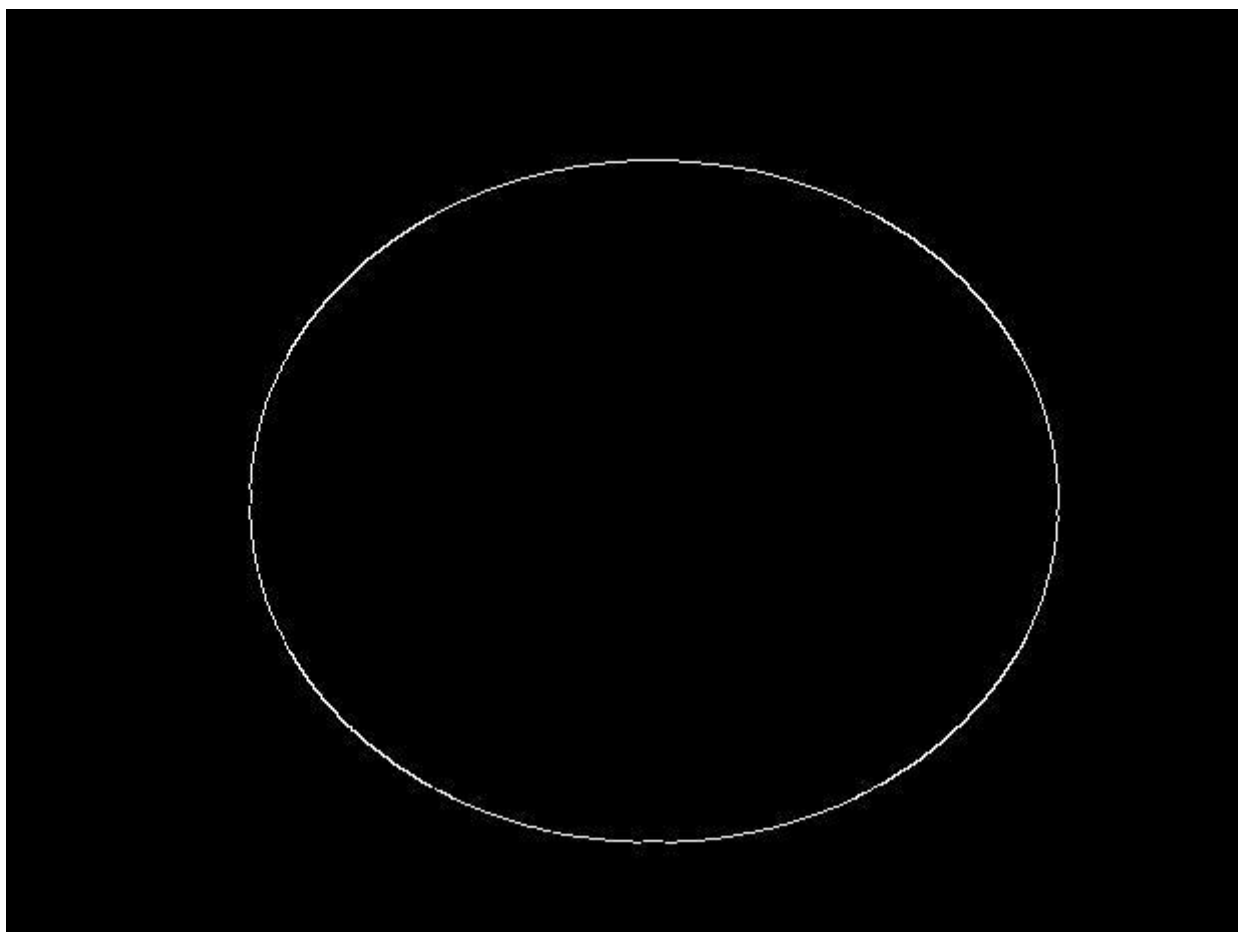

Figure 6: $\alpha = 0.5$. Execution time: 9.16 sec

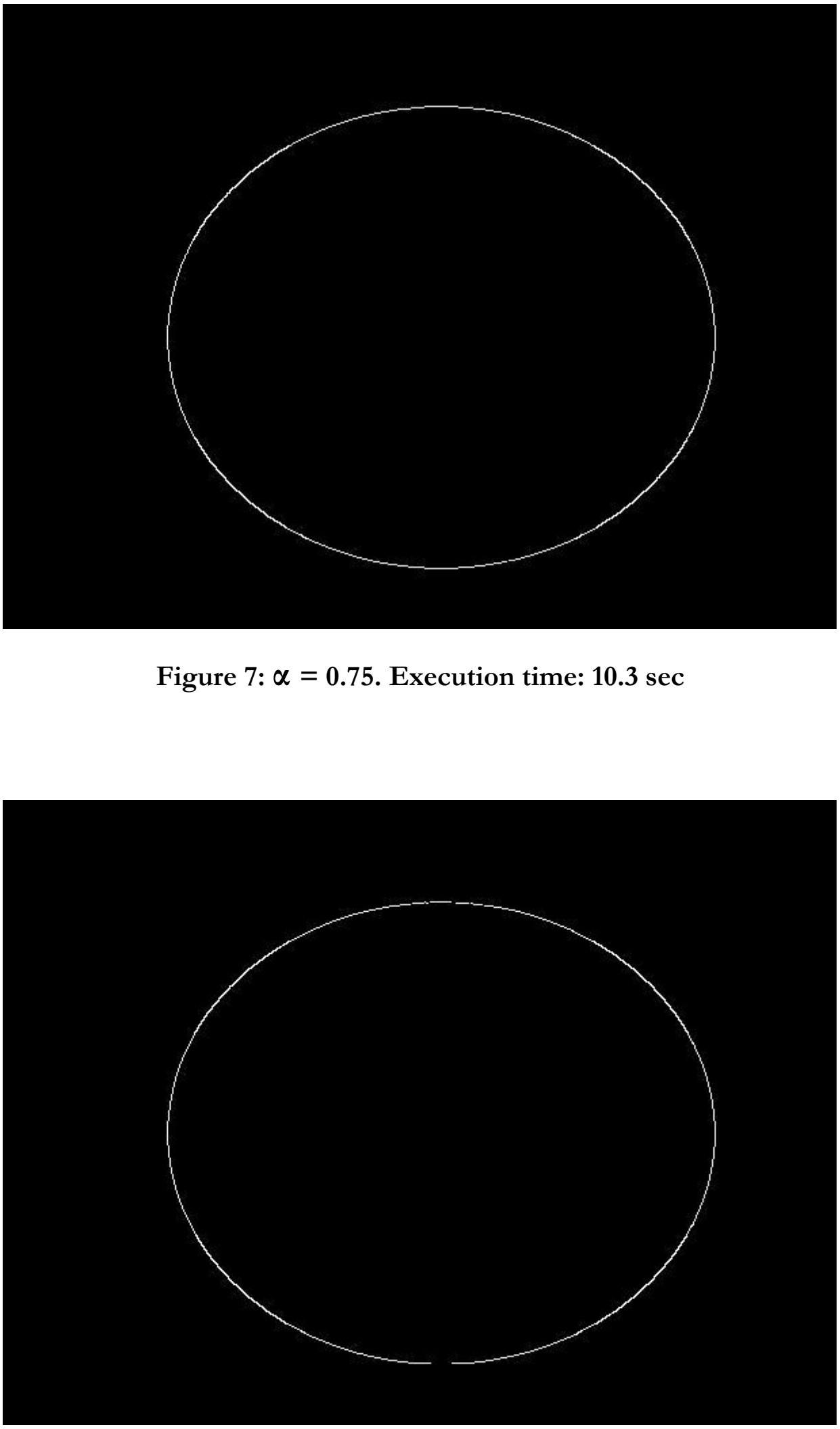

Figure 7: $\alpha = 0.75$. Execution time: 10.3 sec

Figure 8: $\alpha = 1$. Execution time: 10.4 sec

Image 3

Figure 9: Original Image 1. Size 511 x 512

Figure 10: $\alpha = 0.5$. Execution time: 12.4 sec

Figure 11: $\alpha = 0.75$. Execution time: 13.2 sec

Figure 12: $\alpha = 1$. Execution time: 12.7 sec

Image 4

Figure 13: Original Image 1. Size 1024 x 768

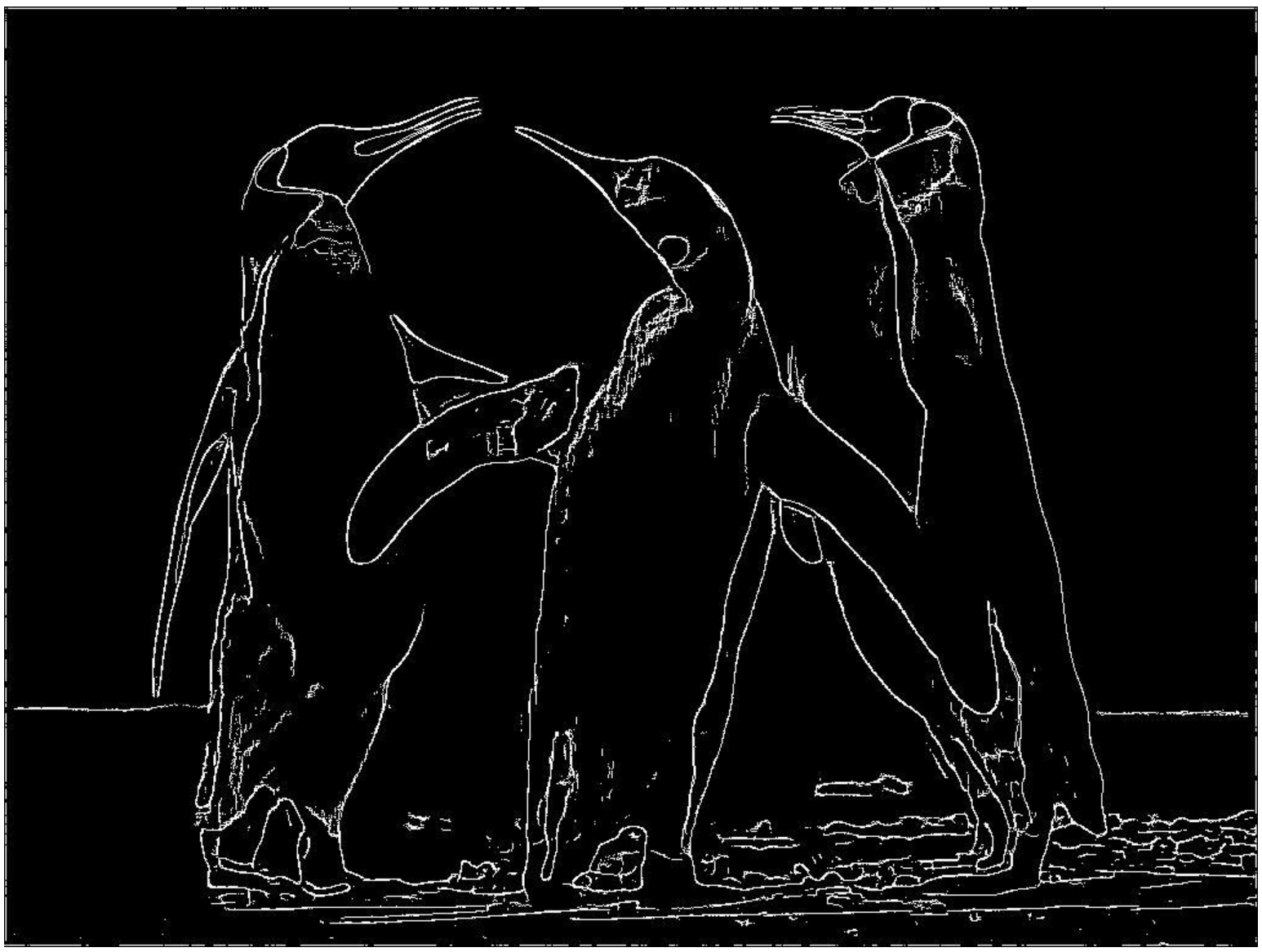

Figure 14: α = 0.5. Execution time: 35.6 sec

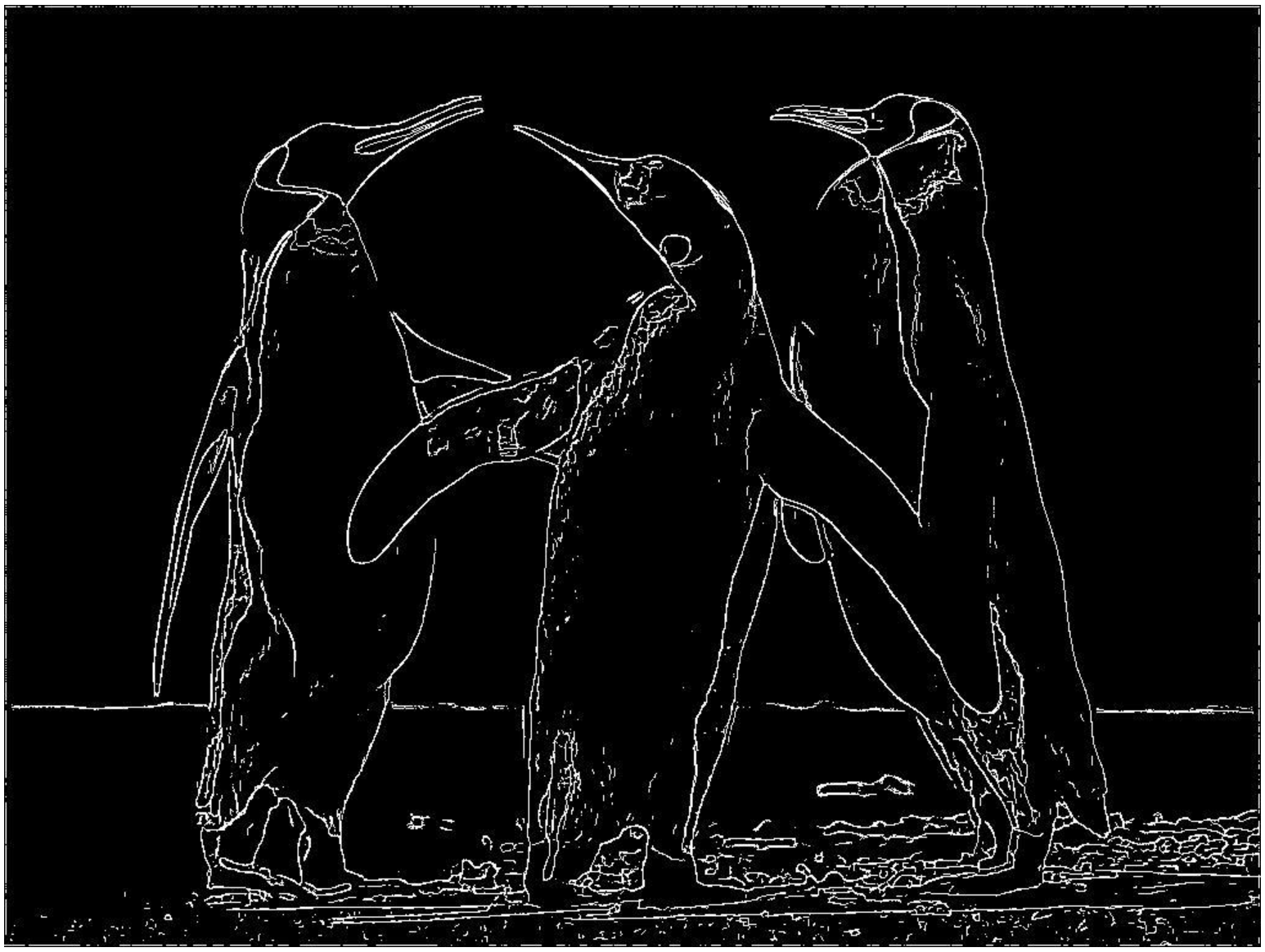

Figure 15: $\alpha = 0.75$. Execution time: 40.2 sec

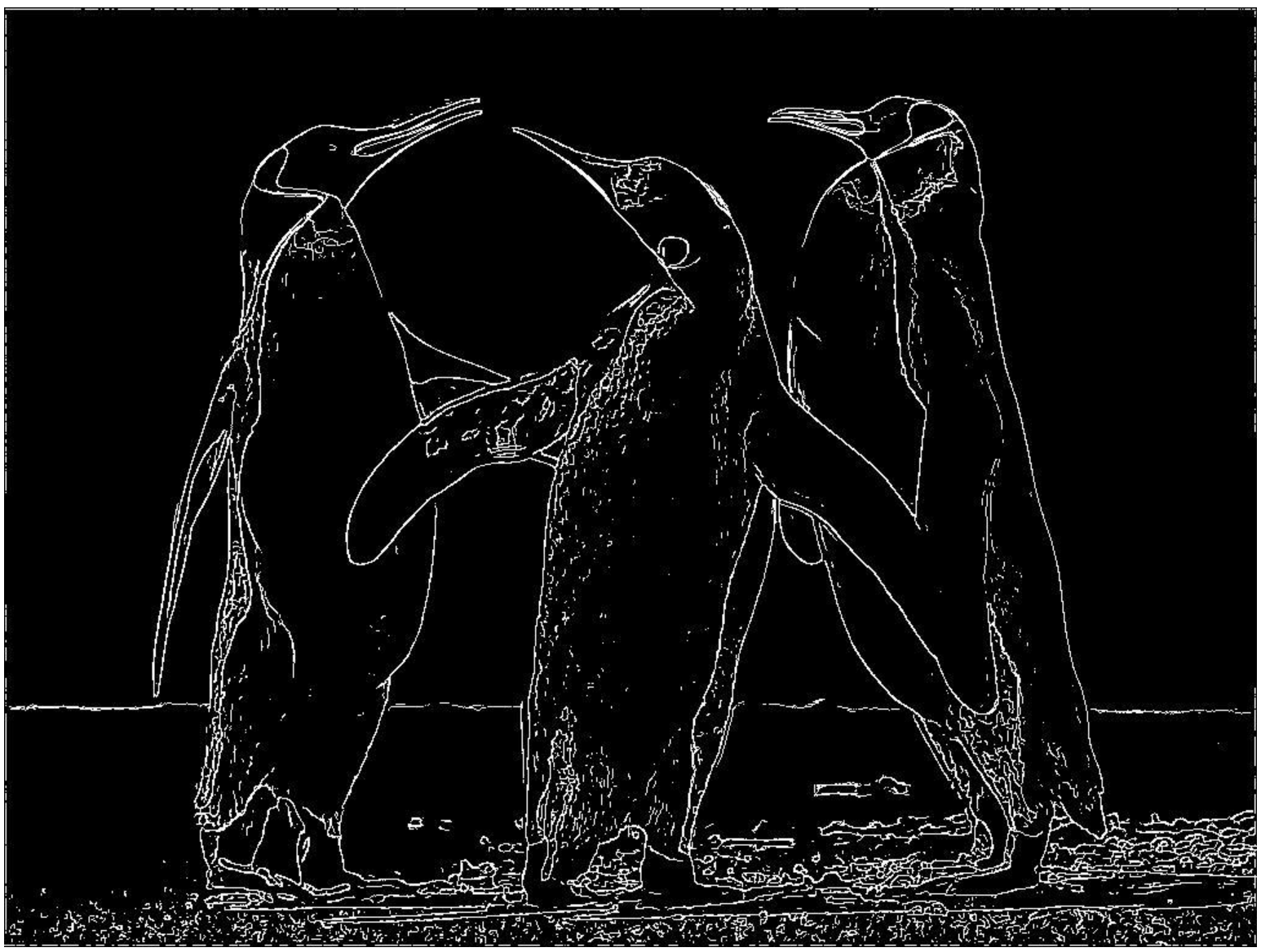

Figure 16: $\alpha = 1$. Execution time: 38 sec