**Problem H1.3:**

1. The evolution of the mean, the maximum, the minimum and the variance is exactly what one would expect with a process of homogeneous diffusion on an image. This process gradually reduces peaks in grey values of the image so that it becomes smoother. This produces the result of a “cloudy image”. This smoothing process mathematically decreases the bigger grey values in the image, while increasing the smallest. That way, peaks get smaller. This in turn means that the maximum grey value in the original image will decrease while the minimum grey value will increase. Moreover, on average the variance will become smaller, since now bigger grey values are closer to the smallest grey values or, in other words, peaks in the image are no longer as pronounced. For example, with timestep and iterations , this is how the values evolve:

|  |  |
| --- | --- |
| initial image  minimum: 51.00  maximum: 191.00  mean: 123.79  standard dev.: 20.38 | iteration: 100  minimum: 79.95 ()  maximum: 165.81 ()  mean: 123.79 (=)  standard dev.: 12.87 () |

On the other hand, for values greater than , the homogeneous diffusion explodes (does not converge) producing images like the following ():

**Imagen que contiene naturaleza, lluvia

Descripción generada automáticamente**

And an evolution of values like the following:

|  |  |
| --- | --- |
| initial image  minimum: 51.00  maximum: 191.00  mean: 123.79  standard dev.: 20.38 | iteration: 100  minimum: -122523368455836.78  maximum: 121898099410075.66  mean: 123.79  standard dev.: 20088437495767.09 |

Original image and the corresponding diffusion-filtered images illustrating the cloudiness at different scales:

|  |  |
| --- | --- |
| **Original Image (fabric.pgm):**  Imagen en blanco y negro  Descripción generada automáticamente con confianza media | **Diffusion-filtered image ():**  **Imagen en blanco y negro  Descripción generada automáticamente con confianza media** |
|  | **Diffusion-filtered image ():**  **Imagen en blanco y negro  Descripción generada automáticamente con confianza media** |

1. The corresponding Gaussian convolution counterparts for the previous diffusion-filtered images. The standard deviation was calculated with the following formula:

|  |  |
| --- | --- |
| **Diffusion-filtered image ():**  **Imagen en blanco y negro  Descripción generada automáticamente con confianza media** | **Gaussian-convoluted image ():**  **Imagen en blanco y negro  Descripción generada automáticamente con confianza media** |
| **Diffusion-filtered image ():**  **Imagen en blanco y negro  Descripción generada automáticamente con confianza media** | **Gaussian-convoluted image ():Imagen en blanco y negro  Descripción generada automáticamente con confianza media** |

|  |  |
| --- | --- |
| **:**  **Imagen en blanco y negro  Descripción generada automáticamente con confianza baja** | **:**  **Imagen en blanco y negro  Descripción generada automáticamente con confianza baja** |

The difference images between the diffusion-filtered image and the corresponding gaussian-convoluted image: