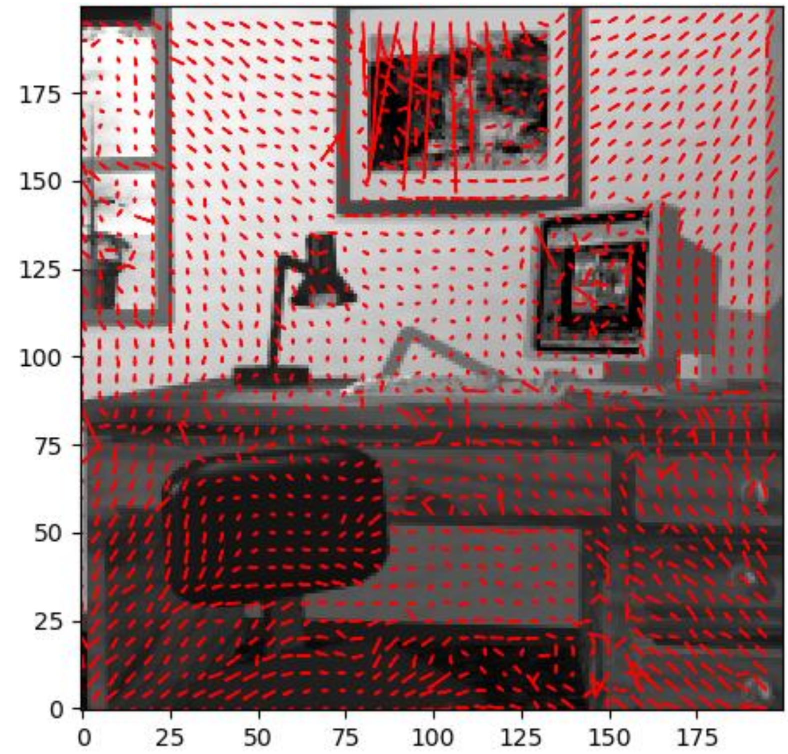
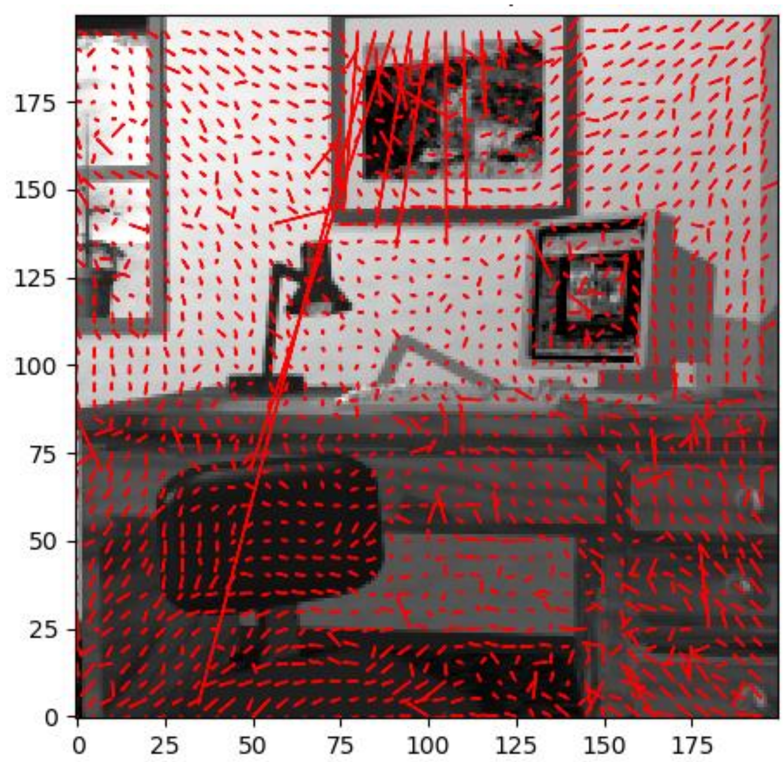
Results:

For the office images:

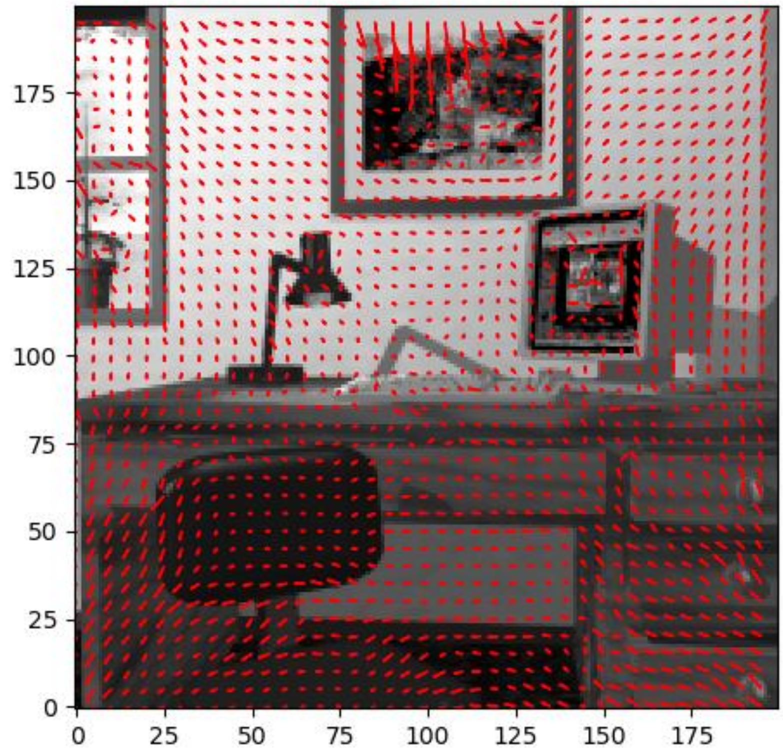
With smoothing parameter 0.0001



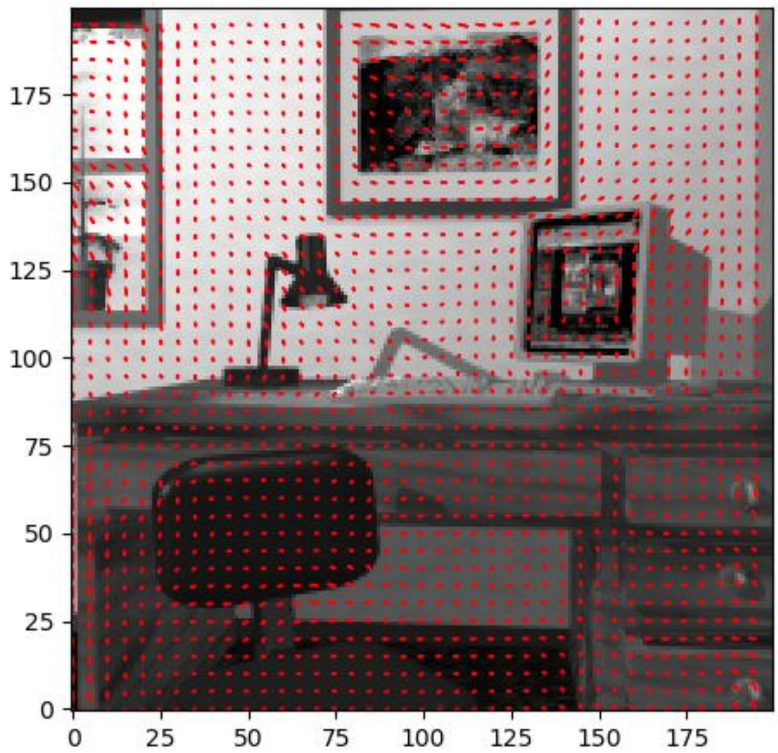
With smoothing parameter 1.0



With smoothing parameter 10.0



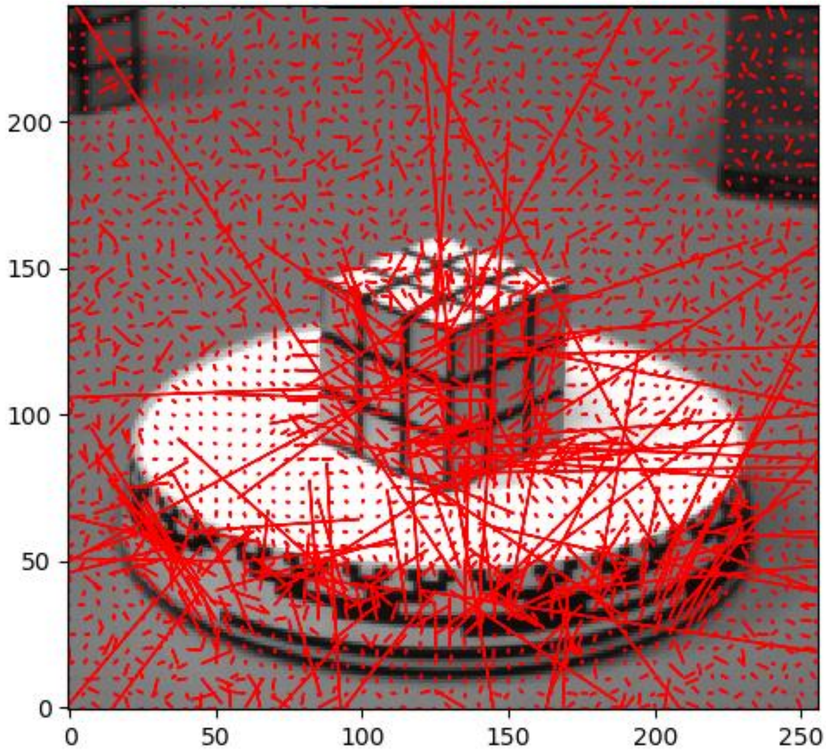
With smoothing parameter 100.0



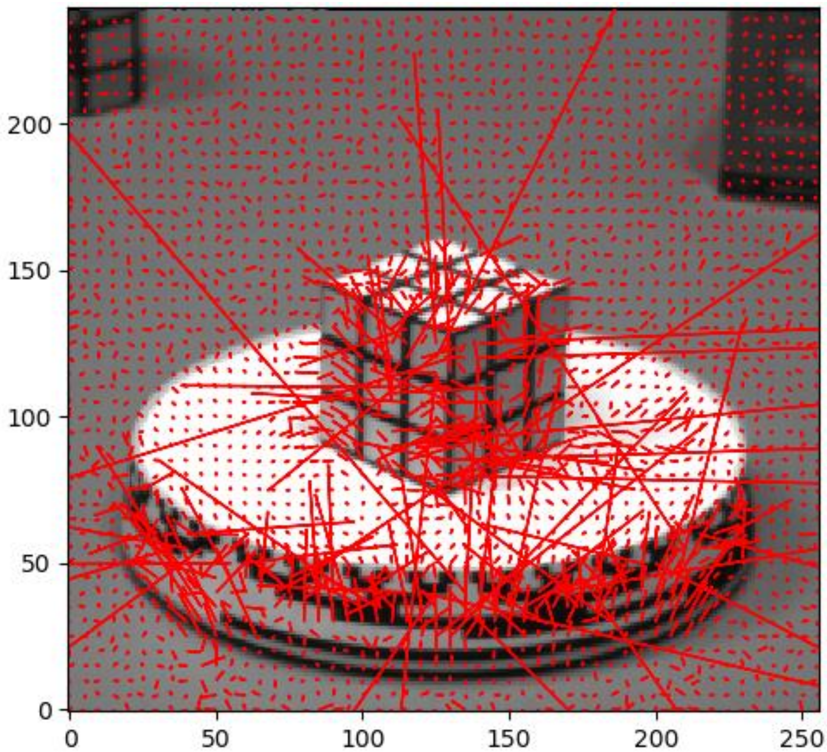
.0

For the rubic images:

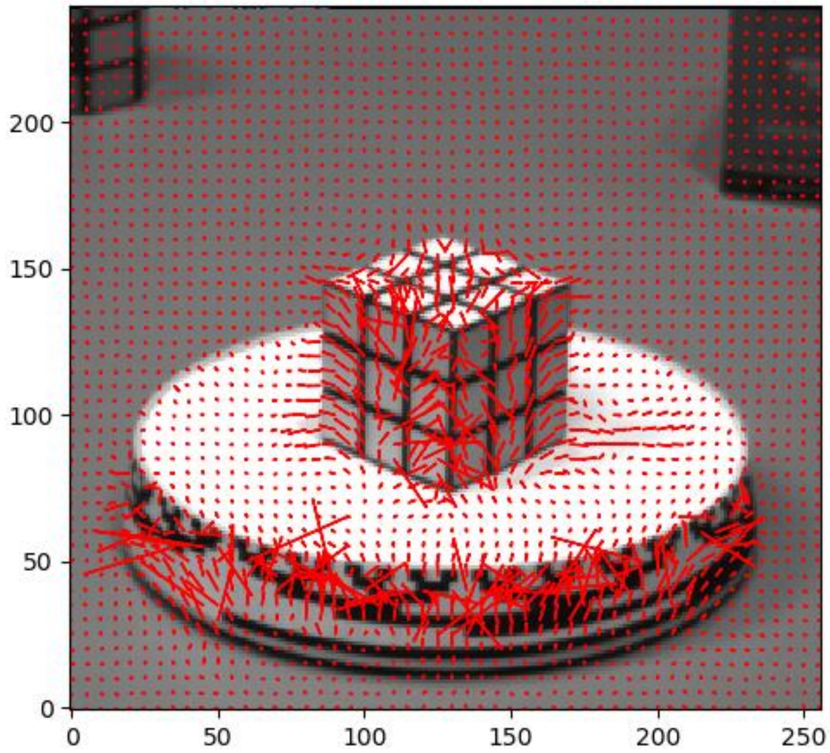
With smoothing parameter 0.0001



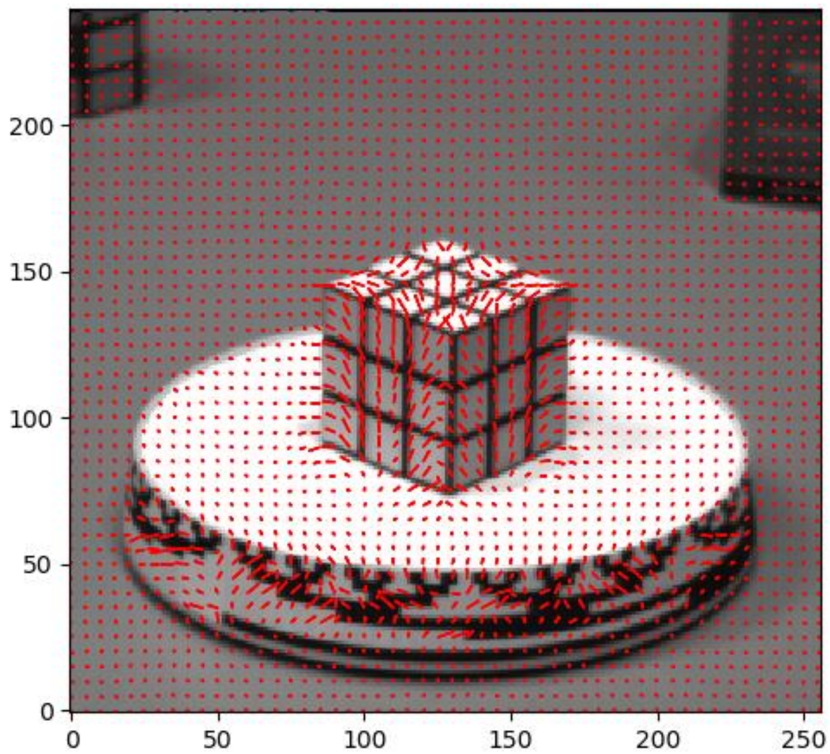
With smoothing parameter 1.0



With smoothing parameter 10.0



With smoothing parameter 100.0.0



From Wikipedia:

The Horn-Schunck algorithm assumes smoothness in the flow over the whole image. Thus, it tries to minimize distortions in flow and prefers solutions which show more smoothness.

The flow is formulated as a global energy functional which is then sought to be minimized. This function is given for two-dimensional image streams as:

$$E = \iint \left[(I_x u + I_y v + I_t)^2 + \alpha^2 (\|\nabla u\|^2 + \|\nabla v\|^2) \right] \mathrm{d}x \mathrm{d}y$$

Where Ix,Iy,It, are the derivatives of the image intensity values along the x, y and time dimensions respectively, $\vec{V} = [u(x,y), v(x,y)]^\top$ is the optical flow vector, and alpha is a regularization constant.

In the code we calculate u and v through the following iterations (the number of iterations is taken from the arguments):

$$u^{k+1} = \overline{u}^k - \frac{I_x(I_x \overline{u}^k + I_y \overline{v}^k + I_t)}{4\alpha^2 + I_x^2 + I_y^2}$$

$$v^{k+1} = \overline{v}^k - \frac{I_y(I_x \overline{u}^k + I_y \overline{v}^k + I_t)}{4\alpha^2 + I_x^2 + I_y^2}$$

And then use the final u and v to draw the quivers in the optical flow outputs.

As seen from the calculations in each iteration, as we enlarge alpha the results throughout the iterations will be closer to each other and therefore the optical flow that we will receive in the end, will be smother. Other profs for the impact of alpha, are the results shown at the beginning of the document.