ExamPerceptionTest2

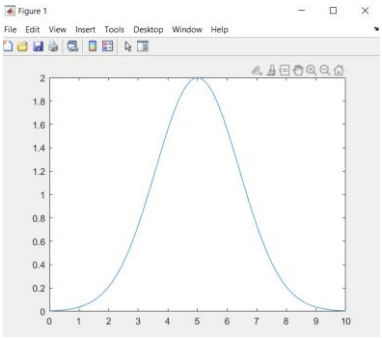
1. Given the following two quaternions, multiply them. Are they unitary, and why? $q_1 = 1 + 2 * i - j + 3 * k$. $q_2 = -1 - i + 2 * j - 2 * k$.

2. Suppose that we have a 1000x1000 pixel camera of 25 mm and and 5 microns of pixel size. The optical center is at Cx = Cy = 1000 / 2. Give the matrix K of the camera. If the projection if in pixels is $p = [550 \quad 720]^T$, what are the coordinates of the normalized projection $\hat{p}$? .

3. We asume that the peak of the laser is given by the equation of a gaussian $y = A * e^{-\left(\frac{x-x_0}{\sigma}\right)^2}$. How do you find the maximum of the laser peak with sub-pixel precision, i.e. x_0. Hint: Take logarithm of the Gaussian equation and solve the resulting equation. Indicate also, how you solve this resulting equation.

   Example of Gaussian function, with A = 2, centered at 5, and σ = 2.

   x = 0:0.01:10;
   y = 2 * exp(-((x-5)/2).^2);
   plot(x,y)



4. Given two cameras, the second one is placed with a rotation R, and translation T, with respect to the first one. Calculate the expression of the point ${}^1M$ in the first camera frame (in the general case in function of a parameter λ), knowing that is projection in normalized coordinates is $\hat{m}_1$. Project this point *M* in the second camera, and give the result of its projection in normalized coordinates, i.e. $\hat{m}_2$.
   Hint: ${}^1M = R * {}^2M + T$.