King Mongkut's University of Technology **Name:** _____

CPE 393 Machine Learning **I.D. Number:** _____

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Take Home Quiz 1 due Sun Jan 29, 2022 **Score:** _____ / 50

1. 10 points. 1.5 hrs. **Template Matching.** Search for the 't' using "t_character.png" as template in the text image "text_image.png". Use a bounding box to mark where 't' were found. Use the Euclidean norm. You may use OpenCV to only read and write the image, but not to call the template matching routine.

2. **Image Convolution.** Create your own Gaussian Kernel

   2.1. *10 points.* 2 hrs. Using Python, compute and print the matrix for Gaussian kernel with σ = 2.5 using kernel size of 15 x 15 (we use width = ceiling (6*σ)). Print the kernel as output.

   2.2. *10 points.* 0.5 hrs. Modify the OpenCV code shown in class to show the result of the convolution of your 15 x 15 Gaussian kernel using the Lenna image.

$$for\ i = -n..n, j = -n..n$$

$$g(i,j) = e^{-\frac{(i^2+j^2)}{2\sigma^2}}$$

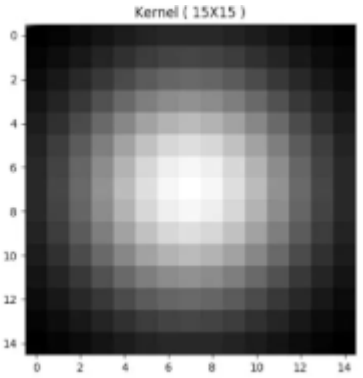
$$G(i,j) = \frac{1}{C} round(\frac{g(i,j)}{g(n,n)})$$

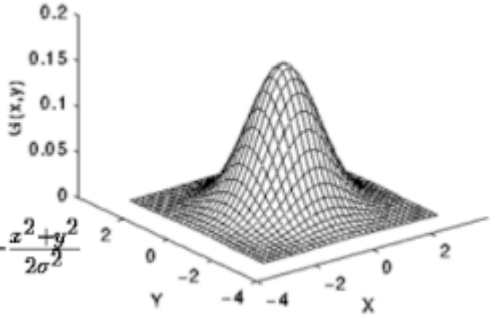
divide each by min or g(n,n) to get integers

$$C = \sum_{i=-n}^{n} \sum_{j=-n}^{n} G(i,j)$$

C is normalizing constant.

$$G(x,y) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}}$$





3. *10 points.* 1 hrs. **KNN (K nearest neighbor) for 3 Classes.** Modify the provided program for KNN with 2 random red/blue classes shown in class to have 3 classes of red/blue/yellow instead. Then use K = 4 to classify a randomly generated sample as red, yellow, or blue.

4. *10 points.* 0.5 hrs. **Image Matching with KNN.** Try the provided image matching program on a test image of an object you photographed yourself. Then photograph the object in a different environment as a target image. Show your input and output image. Also, show the 2 input images with SIFT features as asked for in the jupyter notebook provided.

Submission. All your work should be put into 1 pdf file with source code, input images, output images. There should be only 1 file submission a quiz, unless stated otherwise. For this quiz, also upload your signed Honor Code document. Upload this to the KMUTT LMS for this course before the due date.

Late Quiz Submission Policy. 7 days late allowed, after that 2 points deducted per day late:

```
if  daysLate < 7.00:
  subtractPoints = 0
else:
  subtractPoints = min(daysLate*2, maxPoints)
```