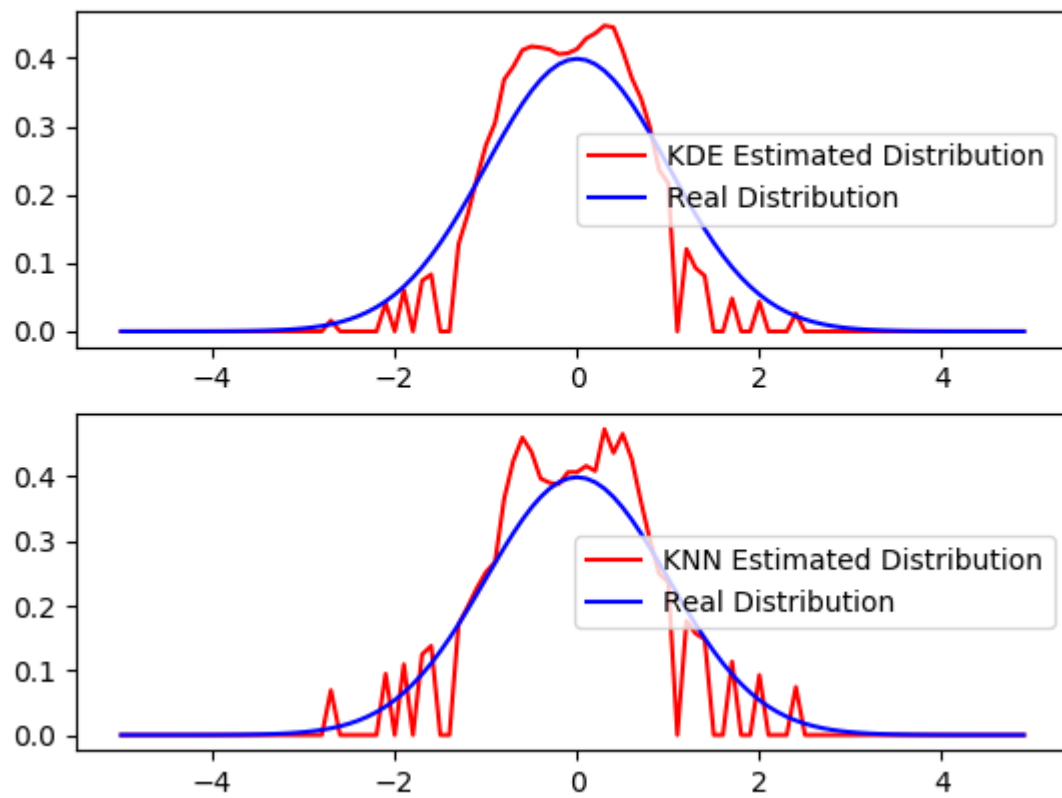
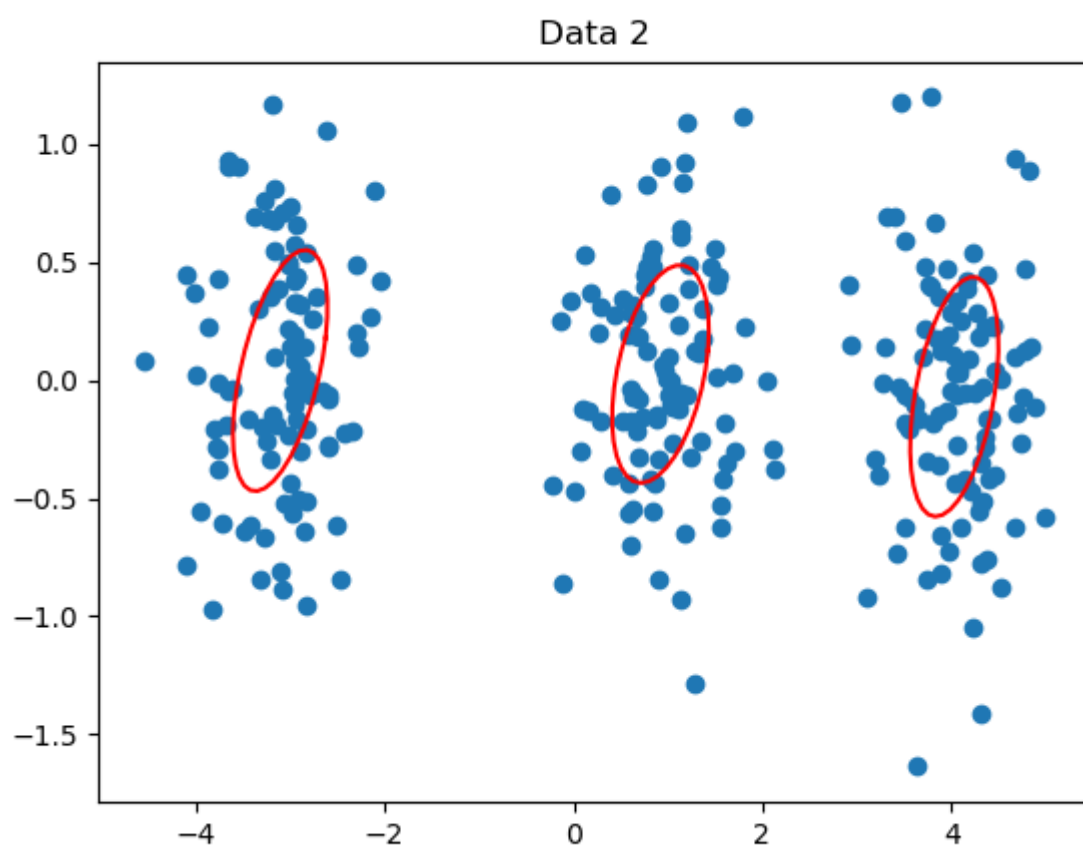
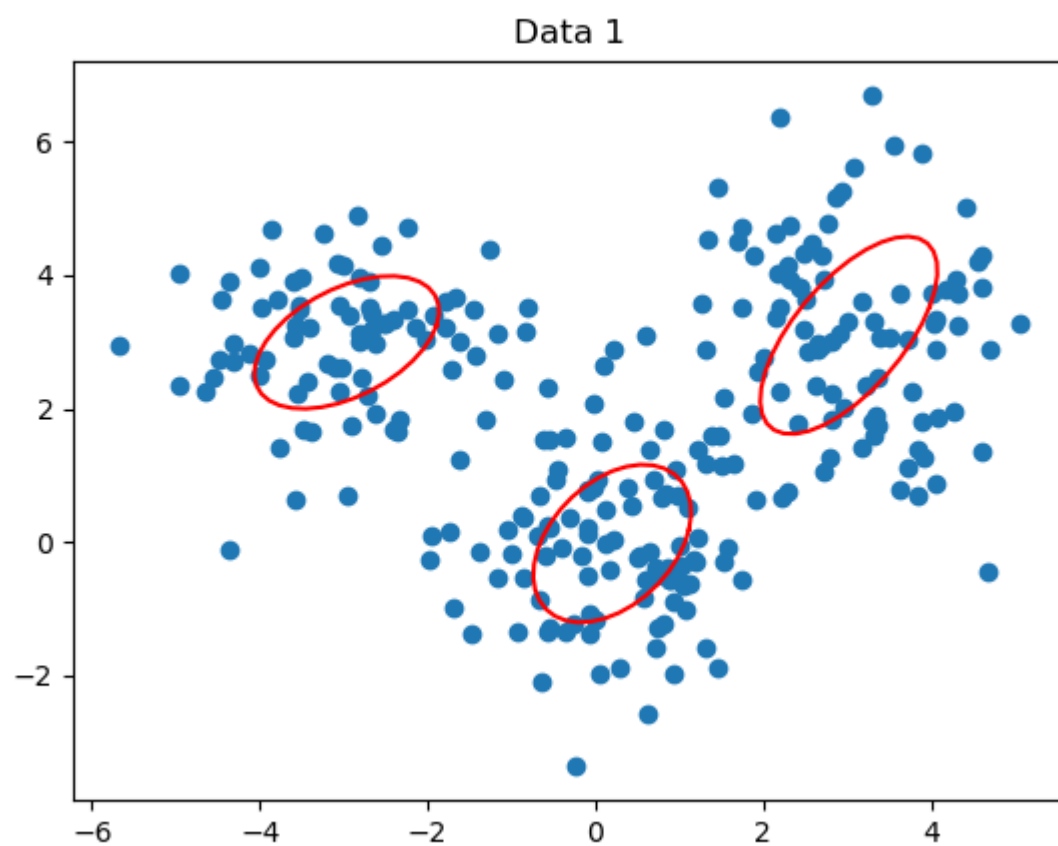


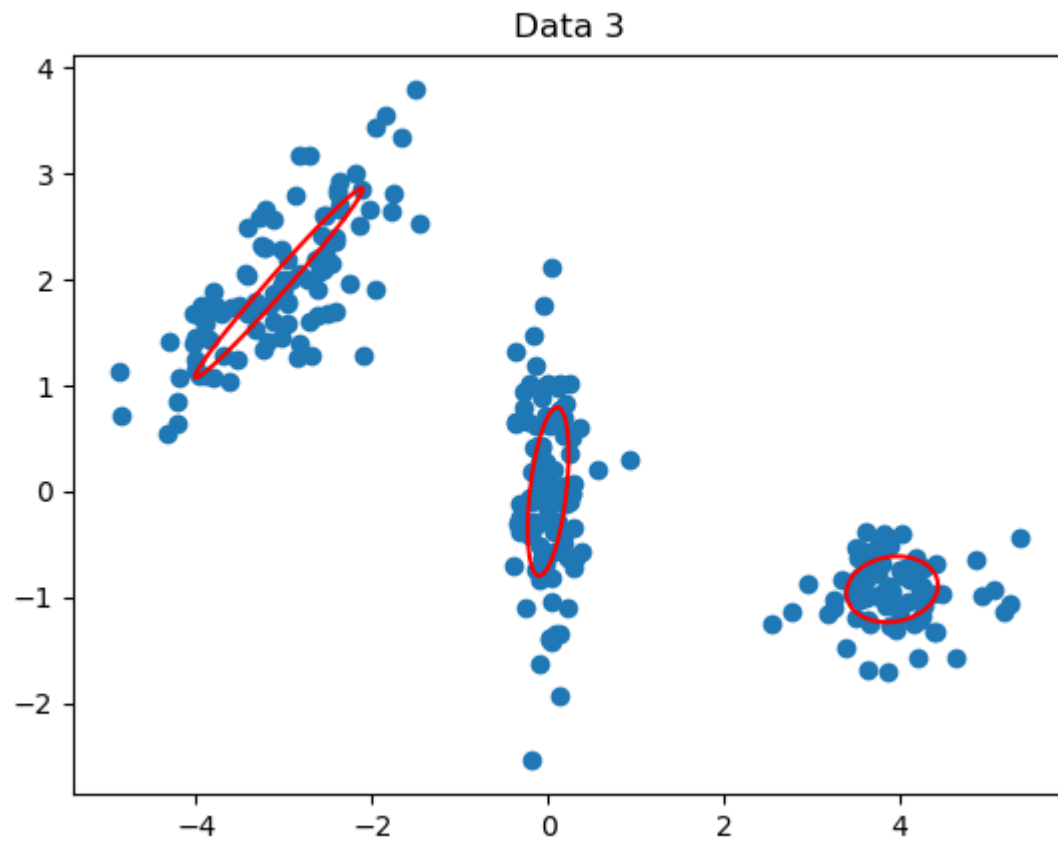
Question 5



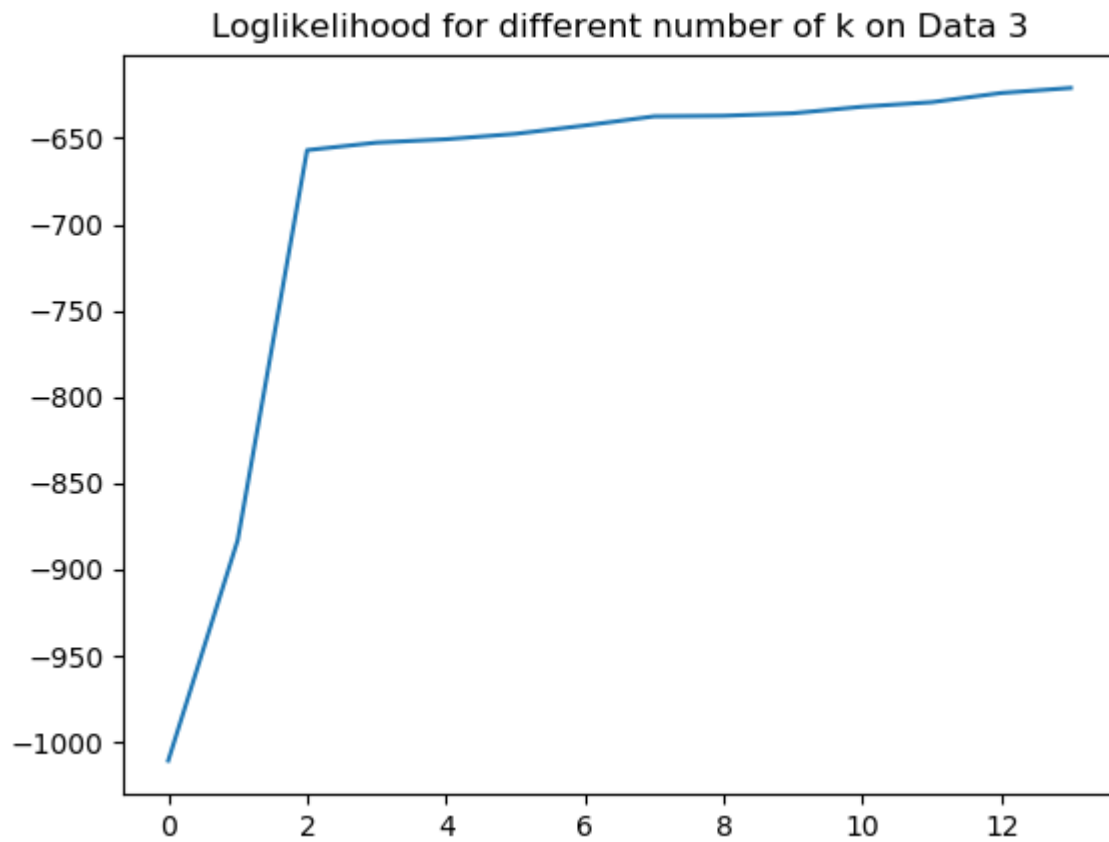
Question 6

(f) results of the program:





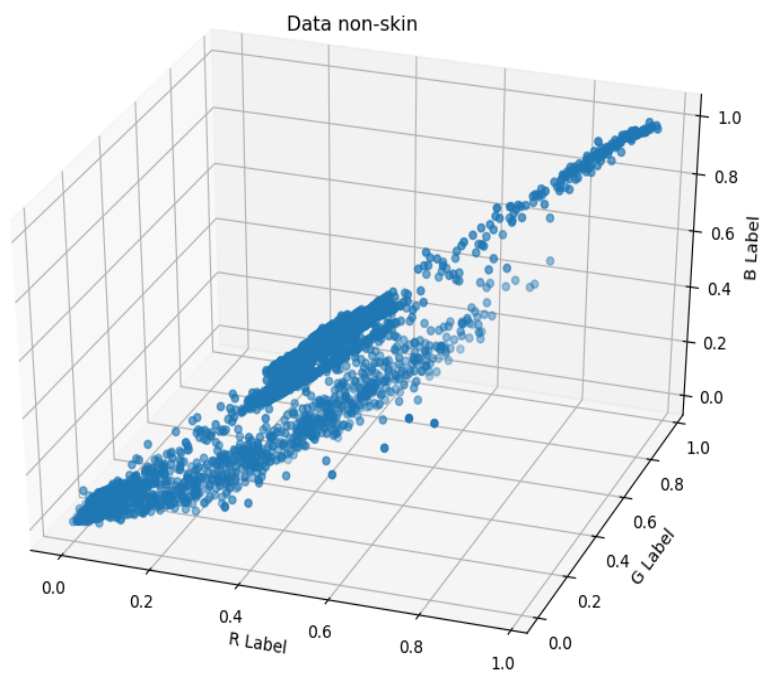
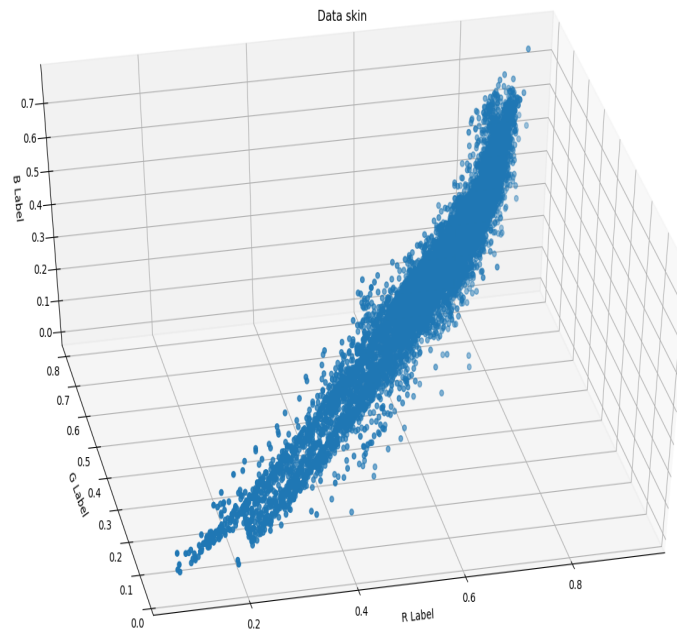
From these figures we see that the classifier works well.



the turning point is at 2 on the X axis, it means $k=3$ because X count from 0. After this point the LogLikelihood grows slowly, so $k=3$ is enough to classify data, big k may cause overfitting.

(g)

look at the training data distribution first:



According to the scatter diagram of training data, it's reasonable to set K as 4. To test we set pairs of parameters and get corresponding outputs. It's also shown that K=4 is right.

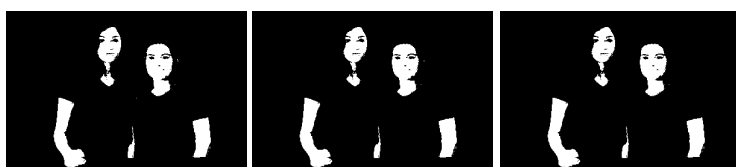
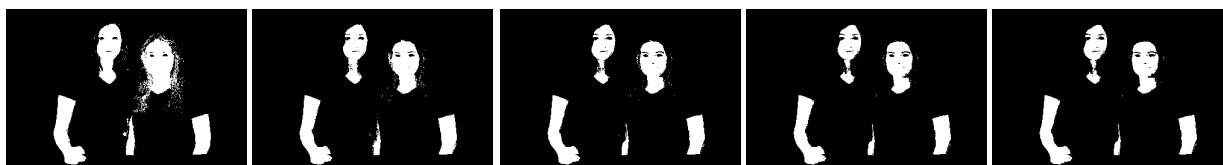
K=2, $\theta=1,2,3,4$



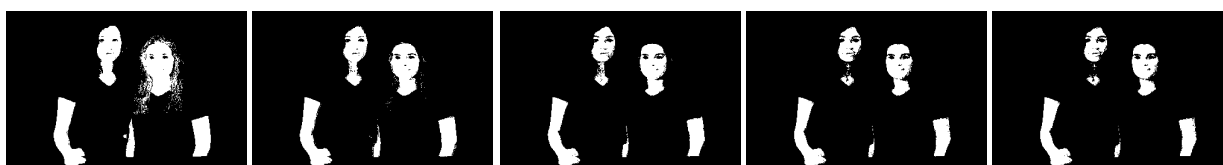
K=3, $\theta=1,2,3,4,50,60$

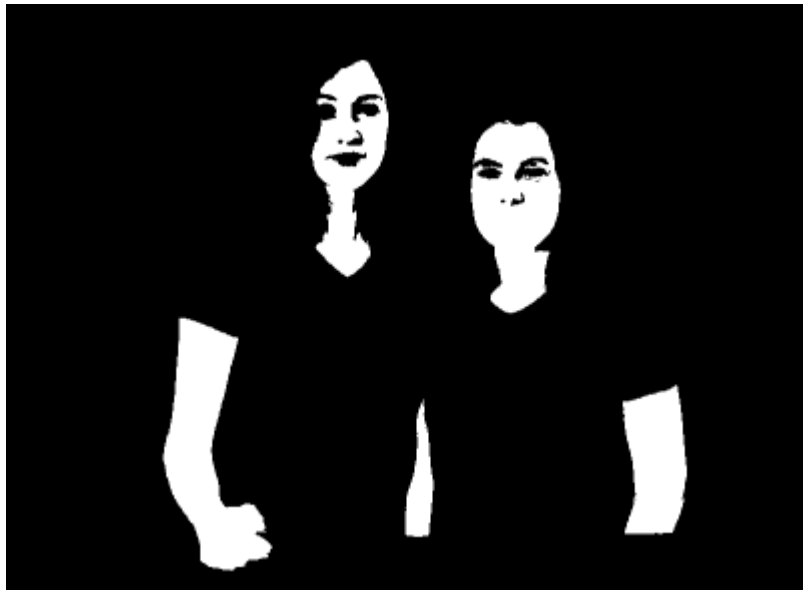


K=4, $\theta=1,10,30,50,60,70,80,90$



K=5, $\theta=1,10,30,60,70$





standard image

So set $K=4$. Compared with standard image, we get best output when $\theta=50$.

For bigger θ the output remain almost the same. Because when $\theta=50$ the ambiguous parts are already classified into black. The rest parts have big difference so that bigger θ can not change their classification.

In conclusion, the best parameter pairs is $K=4$, $\theta=50$.

(h) We tested this program with some pictures, it behaves not well in most situations, when the background is complicate (pic.1 and pic.4), there are too many faces (pic.1 and pic.3), and some colour pieces have similar characters with skin (like pic.2, the tie, and pic.3 the "Bang")

