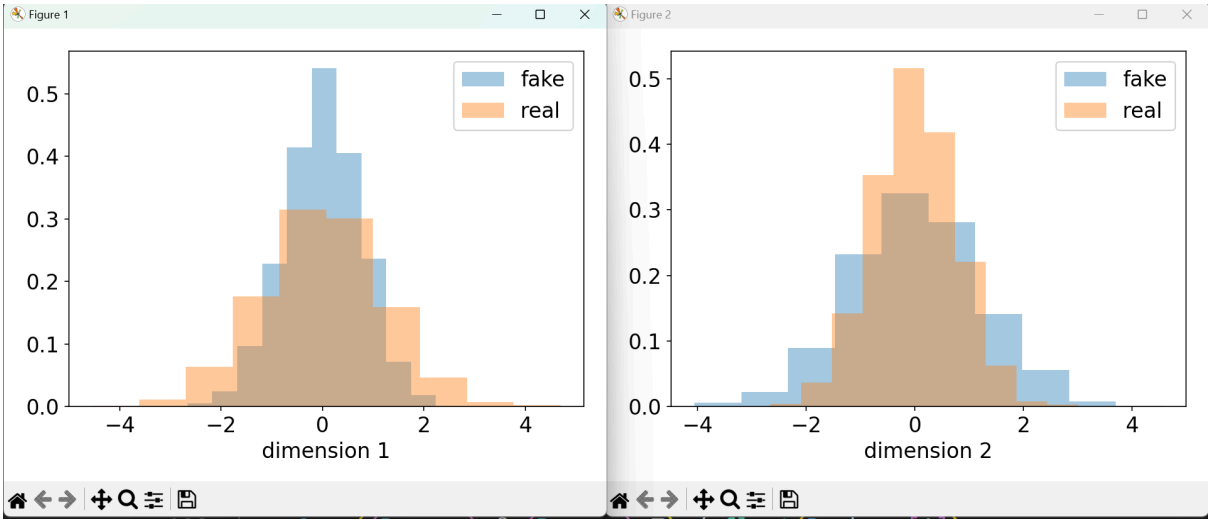
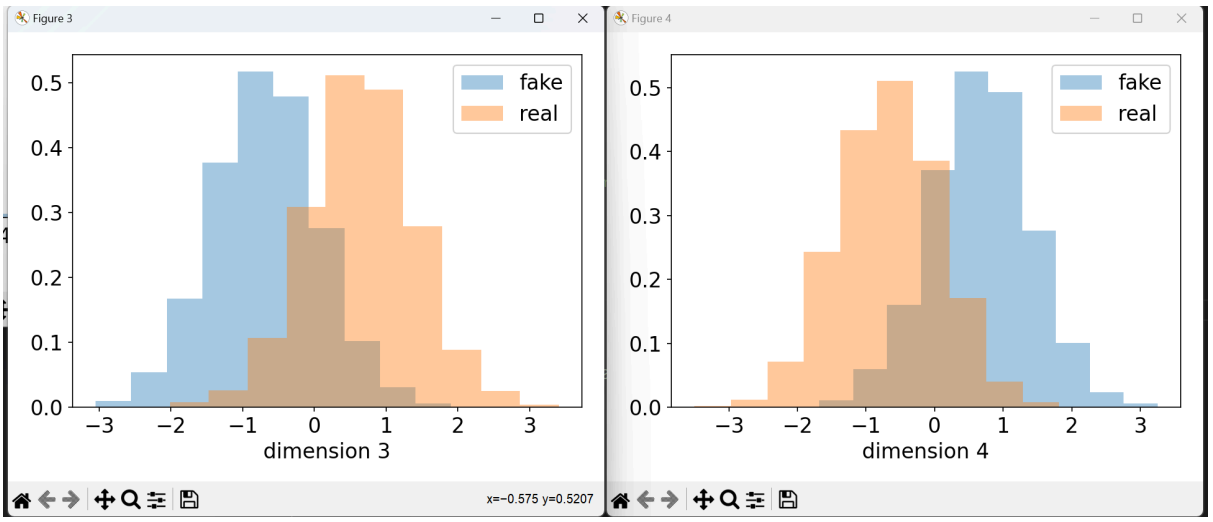
LAB02 REPORT




```
Class 0
Mean:
[[ 0.00287744]
 [ 0.01869316]
 [-0.68094016]
 [ 0.6708362 ]
 [ 0.02795697]
 [-0.0058274 ]]
Covariance:
[[ 5.69581054e-01  4.43400885e-03  8.43170041e-03  1.44479381e-02
   1.42672670e-02 -1.41150344e-03]
 [ 4.43400885e-03  1.42086571e+00 -4.75806611e-03 -1.22432969e-02
  -2.57280214e-03 -5.54092626e-03]
 [ 8.43170041e-03 -4.75806611e-03  5.49977025e-01  1.32035878e-02
  -1.15251868e-02  1.11043986e-02]
 [ 1.44479381e-02 -1.22432969e-02  1.32035878e-02  5.36042661e-01
   7.07380678e-03  1.59744284e-02]
 [ 1.42672670e-02 -2.57280214e-03 -1.15251868e-02  7.07380678e-03
   6.80073597e-01  1.20001652e-02]
 [-1.41150344e-03 -5.54092626e-03  1.11043986e-02  1.59744284e-02
   1.20001652e-02  7.05038438e-01]]
Variance: [0.56958105 1.42086571 0.54997702 0.53604266 0.6800736  0.70503844]
Std. dev.: [0.75470594 1.19200072 0.74160436 0.73214934 0.82466575 0.83966567]
```

```
Class 1
Mean:
[[ 5.44547838e-04]
 [-8.52437392e-03]
 [ 6.65237846e-01]
 [-6.64195349e-01]
 [-4.17251858e-02]
 [ 2.39384879e-02]]
Covariance:
[[ 1.43023345  0.00586459 -0.00328748  0.01305324  0.00569339 -0.02439541]
 [ 0.00586459  0.57827792 -0.0085804  -0.006824   -0.0063889   0.0042779 ]
 [-0.00328748 -0.0085804   0.5489026   0.01126717  0.00465291 -0.01835331]
 [ 0.01305324 -0.006824    0.01126717  0.55334275 -0.00288255  0.02041834]
 [ 0.00569339 -0.0063889   0.00465291 -0.00288255  1.31776792 -0.00914104]
 [-0.02439541  0.0042779  -0.01835331  0.02041834 -0.00914104  1.28702609]]
Variance: [1.43023345 0.57827792 0.5489026  0.55334275 1.31776792 1.28702609]
Std. dev.: [1.19592368 0.76044587 0.74087962 0.74387012 1.14794073 1.13447172]
```

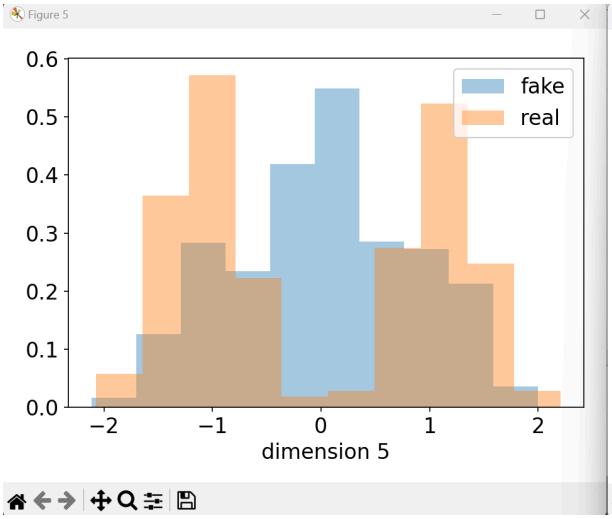
The first two features show opposite behavior around the 0 value, in the first feature there are more fake while in the second more real. The classes overlap at 0 value. The mean is very small for both of them but they differ for some order of magnitude and the variance of the two features is the opposite for the two classes. For both features there are evident peaks at value 0, 0.5,1.5 and 2.5

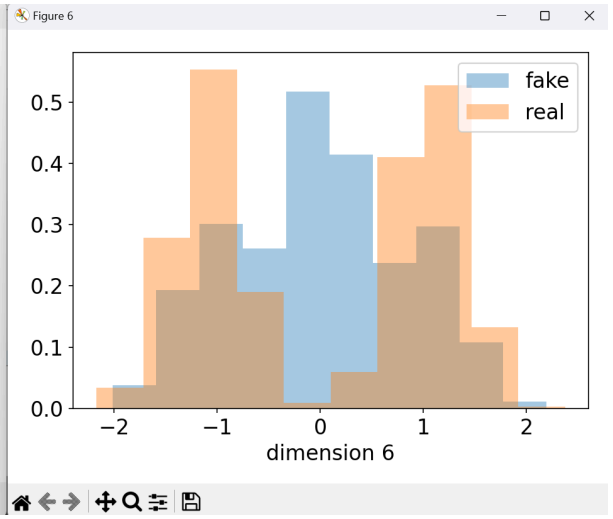



```
Class 0
Mean:
[[ 0.00287744]
 [ 0.01869316]
 [-0.68094016]
 [ 0.6708362 ]
 [ 0.02795697]
 [-0.0058274 ]]
Covariance:
[[ 5.69581054e-01  4.43400885e-03  8.43170041e-03  1.44479381e-02
   1.42672670e-02 -1.41150344e-03]
 [ 4.43400885e-03  1.42086571e+00 -4.75806611e-03 -1.22432969e-02
  -2.57280214e-03 -5.54092626e-03]
 [ 8.43170041e-03 -4.75806611e-03  5.49977025e-01  1.32035878e-02
  -1.15251868e-02  1.11043986e-02]
 [ 1.44479381e-02 -1.22432969e-02  1.32035878e-02  5.36042661e-01
   7.07380678e-03  1.59744284e-02]
 [ 1.42672670e-02 -2.57280214e-03 -1.15251868e-02  7.07380678e-03
   6.80073597e-01  1.20001652e-02]
 [-1.41150344e-03 -5.54092626e-03  1.11043986e-02  1.59744284e-02
   1.20001652e-02  7.05038438e-01]]
Variance: [0.56958105 1.42086571 0.54997702 0.53604266 0.6800736  0.70503844]
Std. dev.: [0.75470594 1.19200072 0.74160436 0.73214934 0.82466575 0.83966567]
```

```
Class 1
Mean:
[[ 5.44547838e-04]
 [-8.52437392e-03]
 [ 6.65237846e-01]
 [-6.64195349e-01]
 [-4.17251858e-02]
 [ 2.39384879e-02]]
Covariance:
[[ 1.43023345  0.00586459 -0.00328748  0.01305324  0.00569339 -0.02439541]
 [ 0.00586459  0.57827792 -0.0085804  -0.006824   -0.0063889   0.0042779 ]
 [-0.00328748 -0.0085804   0.5489026   0.01126717  0.00465291 -0.01835331]
 [ 0.01305324 -0.006824    0.01126717  0.55334275 -0.00288255  0.02041834]
 [ 0.00569339 -0.0063889   0.00465291 -0.00288255  1.31776792 -0.00914104]
 [-0.02439541  0.0042779  -0.01835331  0.02041834 -0.00914104  1.28702609]]
Variance: [1.43023345 0.57827792 0.5489026  0.55334275 1.31776792 1.28702609]
Std. dev.: [1.19592368 0.76044587 0.74087962 0.74387012 1.14794073 1.13447172]
```

The 3rd and 4th features have the classes overlapping way less than the first two features, although there is still a bit of overlapping around the values equals zero. Feature 3 has a negative mean in class 0 while it is positive in class 1, while feature 4 does the opposite, whit a positive mean for class 0 and a negative one for class 1. The variance are pretty similar. We can see modes at these values: 0.5,-0.5,1.5,-1.5,2,-2

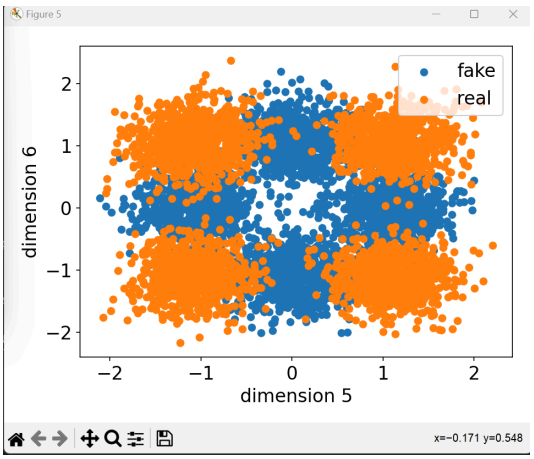





```
Class 0
Mean:
[[ 0.00287744]
 [ 0.01869316]
 [-0.68094016]
 [ 0.6708362 ]
 [ 0.02795697]
 [-0.0058274 ]]
Covariance:
[[ 5.69581054e-01  4.43400885e-03  8.43170041e-03  1.44479381e-02
   1.42672670e-02 -1.41150344e-03]
 [ 4.43400885e-03  1.42086571e+00 -4.75806611e-03 -1.22432969e-02
  -2.57280214e-03 -5.54092626e-03]
 [ 8.43170041e-03 -4.75806611e-03  5.49977025e-01  1.32035878e-02
  -1.15251868e-02  1.11043986e-02]
 [ 1.44479381e-02 -1.22432969e-02  1.32035878e-02  5.36042661e-01
   7.07380678e-03  1.59744284e-02]
 [ 1.42672670e-02 -2.57280214e-03 -1.15251868e-02  7.07380678e-03
   6.80073597e-01  1.20001652e-02]
 [-1.41150344e-03 -5.54092626e-03  1.11043986e-02  1.59744284e-02
   1.20001652e-02  7.05038438e-01]]
Variance: [0.56958105 1.42086571 0.54997702 0.53604266 0.6800736  0.70503844]
Std. dev.: [0.75470594 1.19200072 0.74160436 0.73214934 0.82466575 0.83966567]
```

```
Class 1
Mean:
[[ 5.44547838e-04]
 [-8.52437392e-03]
 [ 6.65237846e-01]
 [-6.64195349e-01]
 [-4.17251858e-02]
 [ 2.39384879e-02]]
Covariance:
[[ 1.43023345  0.00586459 -0.00328748  0.01305324  0.00569339 -0.02439541]
 [ 0.00586459  0.57827792 -0.0085804  -0.006824   -0.0063889   0.0042779 ]
 [-0.00328748 -0.0085804   0.5489026   0.01126717  0.00465291 -0.01835331]
 [ 0.01305324 -0.006824    0.01126717  0.55334275 -0.00288255  0.02041834]
 [ 0.00569339 -0.0063889   0.00465291 -0.00288255  1.31776792 -0.00914104]
 [-0.02439541  0.0042779  -0.01835331  0.02041834 -0.00914104  1.28702609]]
Variance: [1.43023345 0.57827792 0.5489026  0.55334275 1.31776792 1.28702609]
Std. dev.: [1.19592368 0.76044587 0.74087962 0.74387012 1.14794073 1.13447172]
```

These last two features behave in a different way than the previous ones, the classes overlap at around value 1 for both of them and we can see evident modes at these values: 0,-1,1



The scatter plot is very interesting because we can see the class distribution among the different values of the features. It's clearly visible in the graph the presence of 4 clusters for each class,depending on the values of the features.