

GÖRÜNTÜ İŞLEME DERSİ 3. ÖDEV RAPORU



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YÖNTEM

Öncelikle gerekli kütüphaneleri import'luyoruz. Daha sonrasında verilen "trainLabels.csv" dosyasından sınıfların labellarını çekiyoruz. Daha sonra bu Label'ları bir yerde saklıyoruz.

Verilen veri setinin Keras'ın içerisinde hazır bulunan CIFAR10 veri setinden bir farkı var. Kerastaki hazır veri seti 10.000 test görüntüsü içerirken verilen veri setinde 300.000 test görüntüsü var. Hazır veri setindeki 10.000 test görüntüsü üstüne 290.000 junk image eklenmiş. Bu yüzden Keras üstünden veri setini çekmiyoruz ve Kaggle'dan indirerek localimizde çalışıyoruz.

Normalde kerastan çektiğimizde çekilen görüntülerin dimension'ları otomatik istenilen değışkene atılıyor fakat biz local'den çalıştığımız için train ve test kısmındaki directory'leri girdikten sonra fotoğrafların dimension'ını elle atıyoruz.

Train verilerinin yüzde 80 ini eğitim yüzde 20 sini validation verileri olarak kullanıyoruz.

Daha sonra ödev dökümanında verilen kurallara göre modellerimizi kurup en başarılı sonuç elde ettiğimiz modeli predict için saklıyoruz.

Batch Size: 32

Epoch: 20

3 katmanlı modeller için yaklaşık -> 1 tur 1 dk

5 katmanlı modeller için yaklaşık -> 1 tur 2.5 dk sürüyor.

Bu sonuçlar i7-9750h işlemcili kişisel bilgisayarımda böyle gerçekleşti.

Confusion Matrix görselleştirmesi için heatmap kullanıldı.

Modelin tüm sınıflar için Confusion Matrix'i görselleştirildi.

Modelin mimarisi, ağırlıkları ve kendisi daha sonra tekrar kullanılmak üzere saklandı.

Ödevde yok ama tüm Test verileri label'landı.

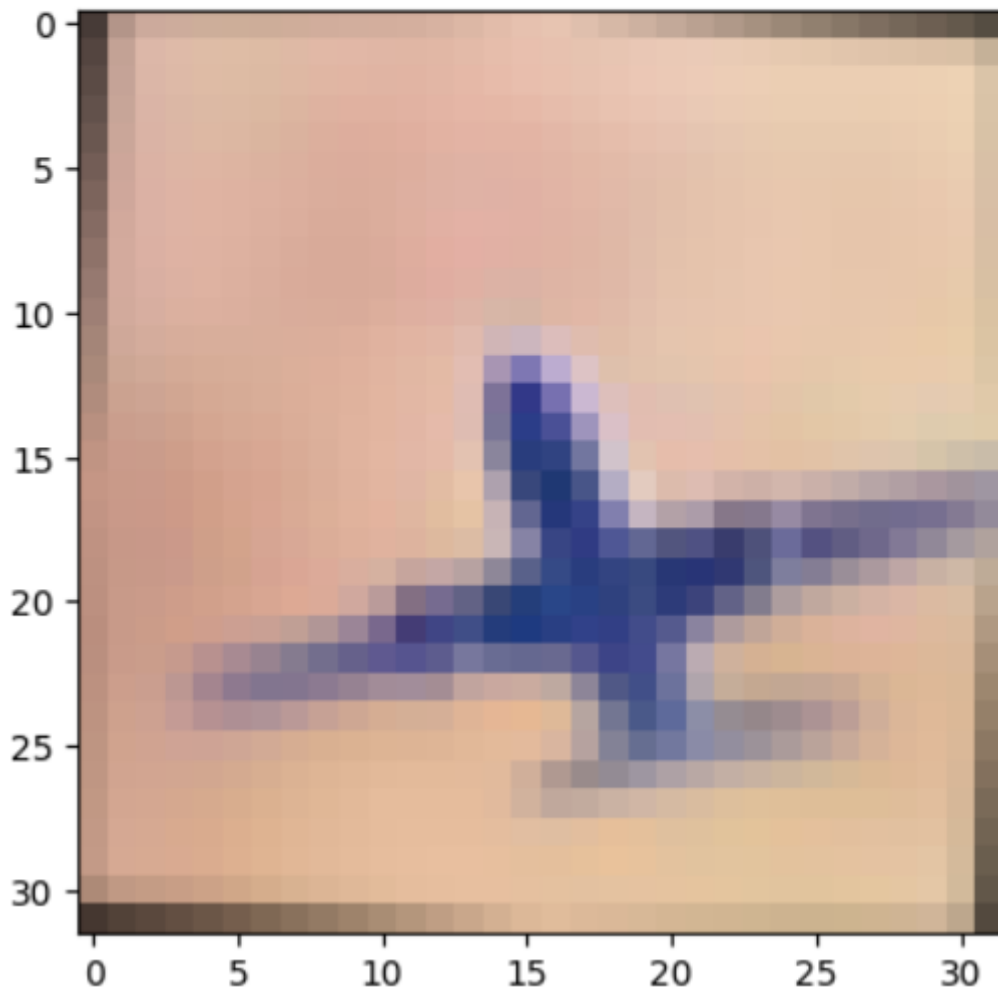
Daha sonra test verileri arasından her sınıftan 3 er tane olmak üzere örnek fotoğraflar toplandı.

Her fotoğrafın diğer sınıflara ne kadar benzediğinin olasılık değerleri döndürülerek sıralandı ve en yakın 5 sınıfın olasılık değerleri getirildi.

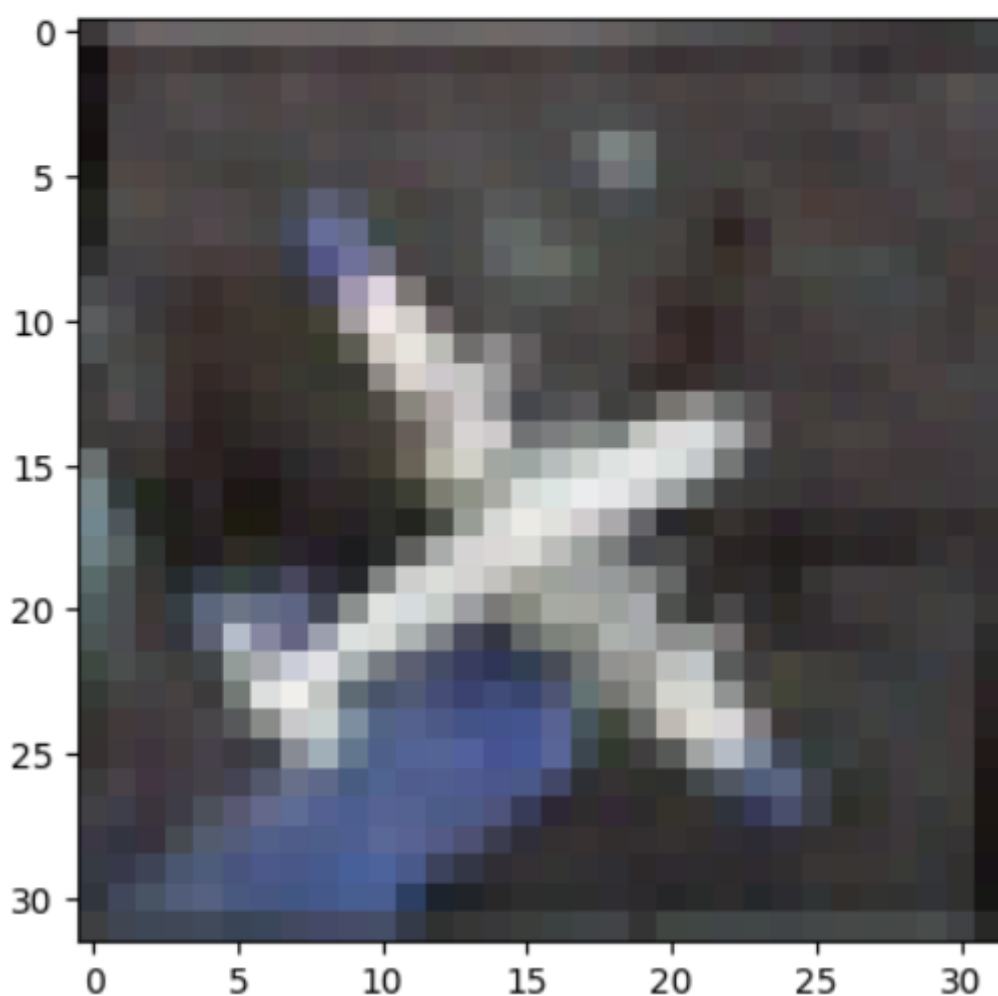
En son olarak da sorgu için kullandığımız 30 resmin Confusion Matrix'i yazdırıldı.

UYGULAMA

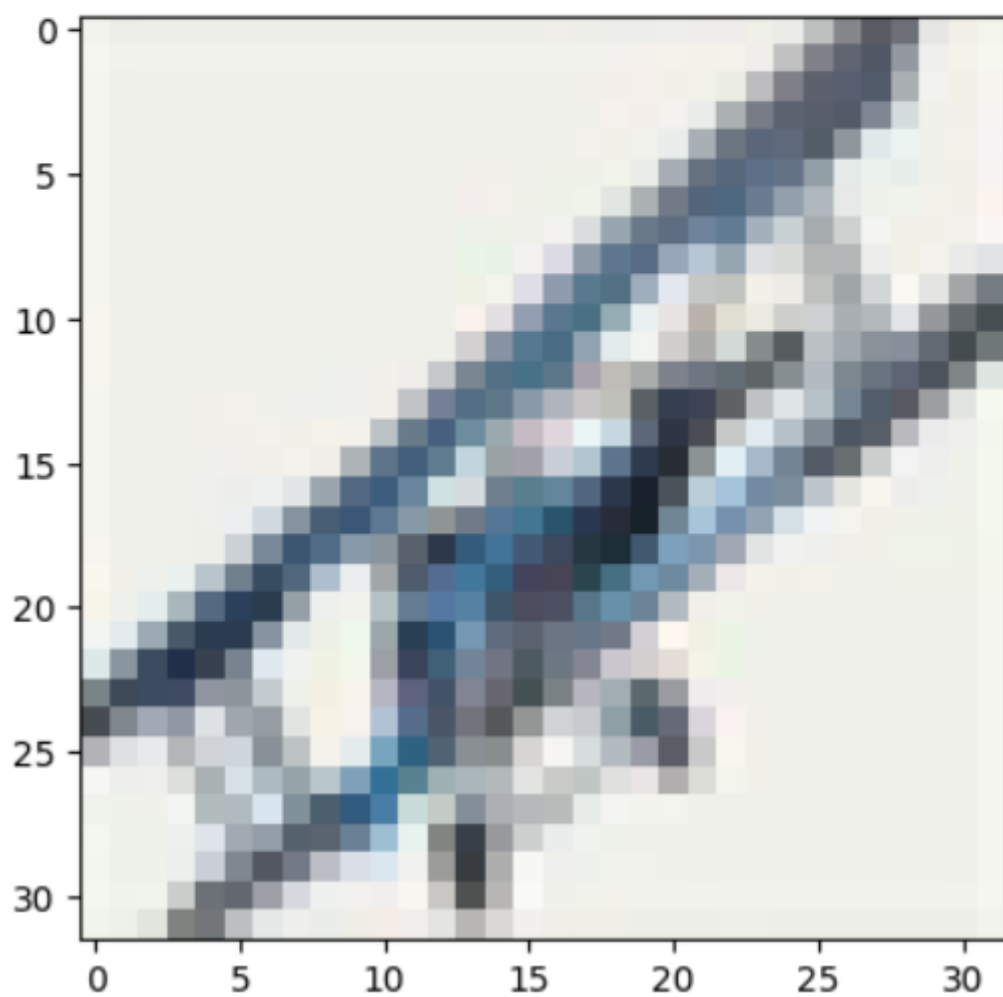
```
1/1 [=====] - 0s 19ms/step
1. airplane <-----> 0.9076985716819763
2. deer <-----> 0.06609100103378296
3. bird <-----> 0.025894014164805412
4. ship <-----> 0.000150993000715971
5. automobile <-----> 4.7891047870507464e-05
6. horse <-----> 4.17389819631353e-05
7. truck <-----> 3.7676538340747356e-05
8. frog <-----> 3.177591133862734e-05
9. cat <-----> 3.99287910113344e-06
10. dog <-----> 2.3547768250864465e-06
```



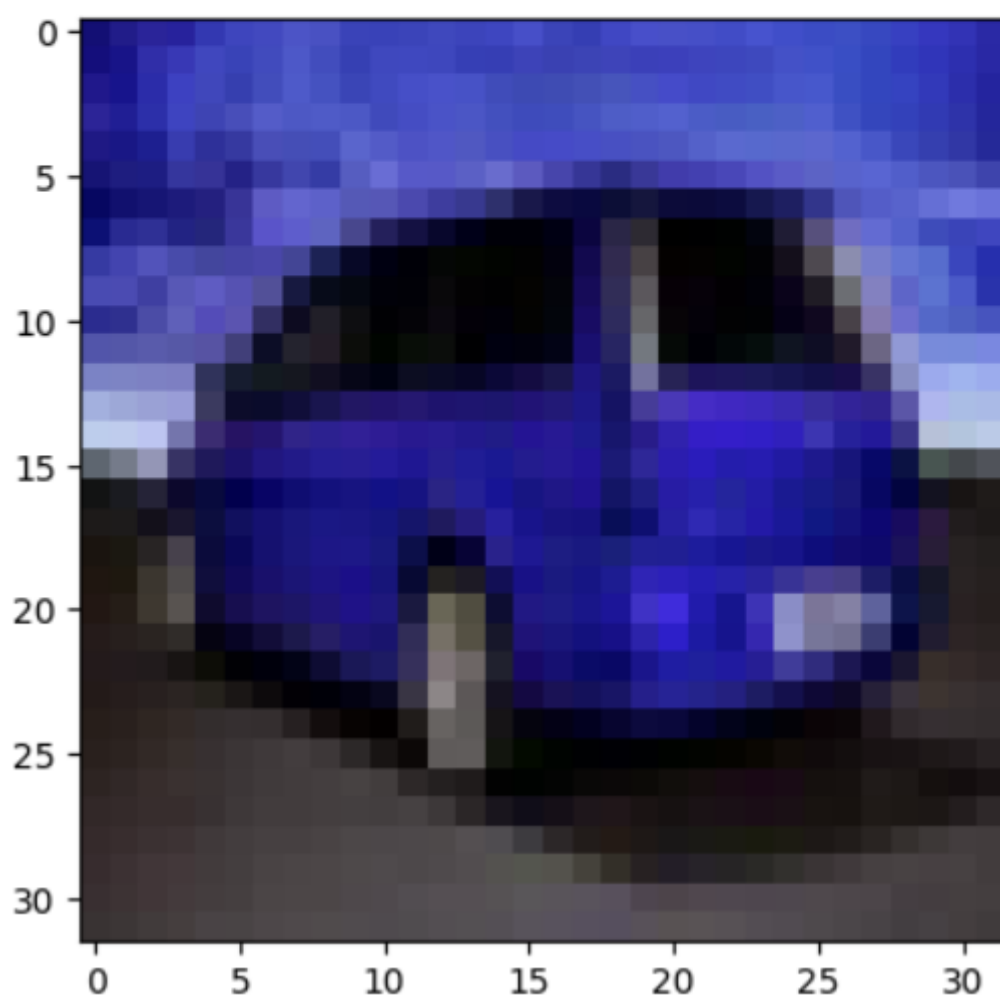
```
1/1 [=====] - 0s 23ms/step
1. airplane <-----> 0.9977966547012329
2. bird <-----> 0.0010183844715356827
3. deer <-----> 0.0005942240823060274
4. ship <-----> 0.00039098001434467733
5. frog <-----> 0.00018014511442743242
6. dog <-----> 6.925545221747598e-06
7. horse <-----> 6.481133823399432e-06
8. cat <-----> 4.891451226285426e-06
9. truck <-----> 7.124656349333236e-07
10. automobile <-----> 6.36658455732686e-07
```



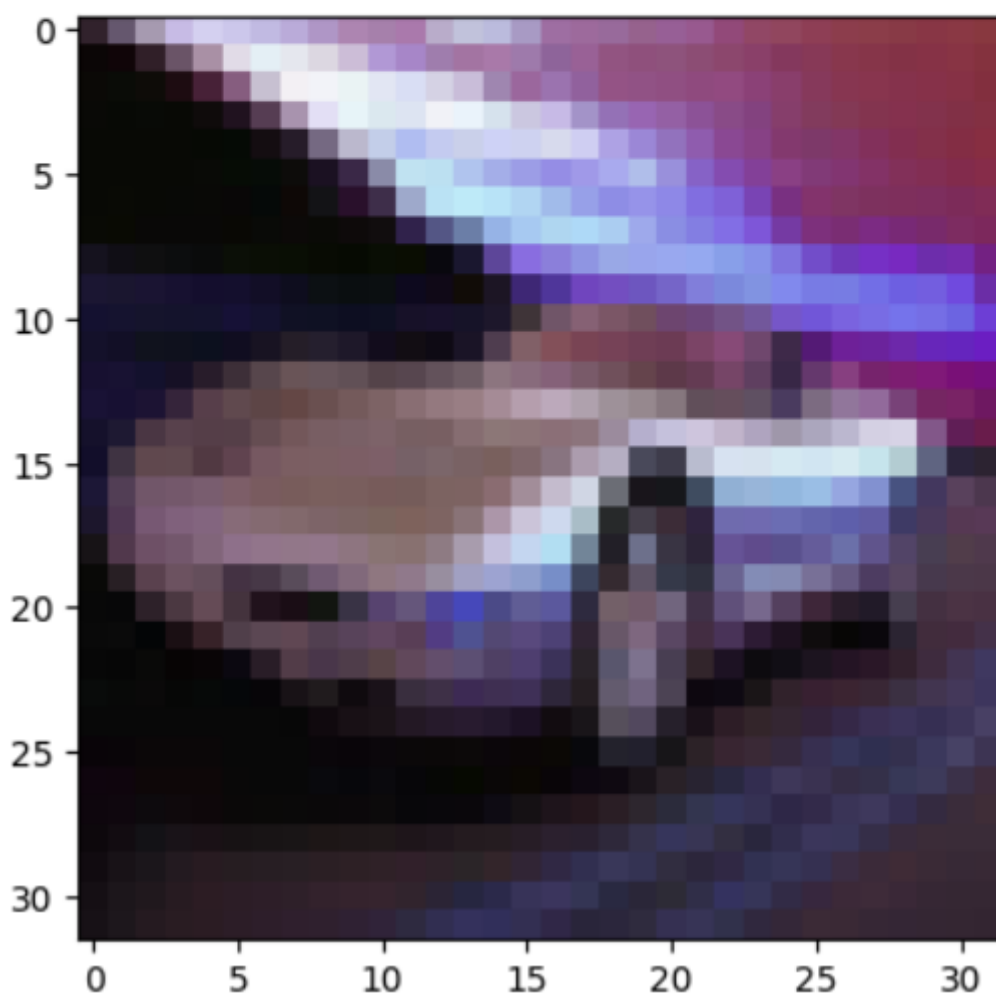
```
1/1 [=====] - 0s 22ms/step
1. bird <-----> 0.915541410446167
2. airplane <-----> 0.08111061155796051
3. frog <-----> 0.0016916142776608467
4. deer <-----> 0.0010805907659232616
5. ship <-----> 0.0002465047291480005
6. truck <-----> 0.00011735486623365432
7. horse <-----> 0.00010197309165960178
8. automobile <-----> 8.165941835613921e-05
9. dog <-----> 2.1084395484649576e-05
10. cat <-----> 7.206380360003095e-06
```



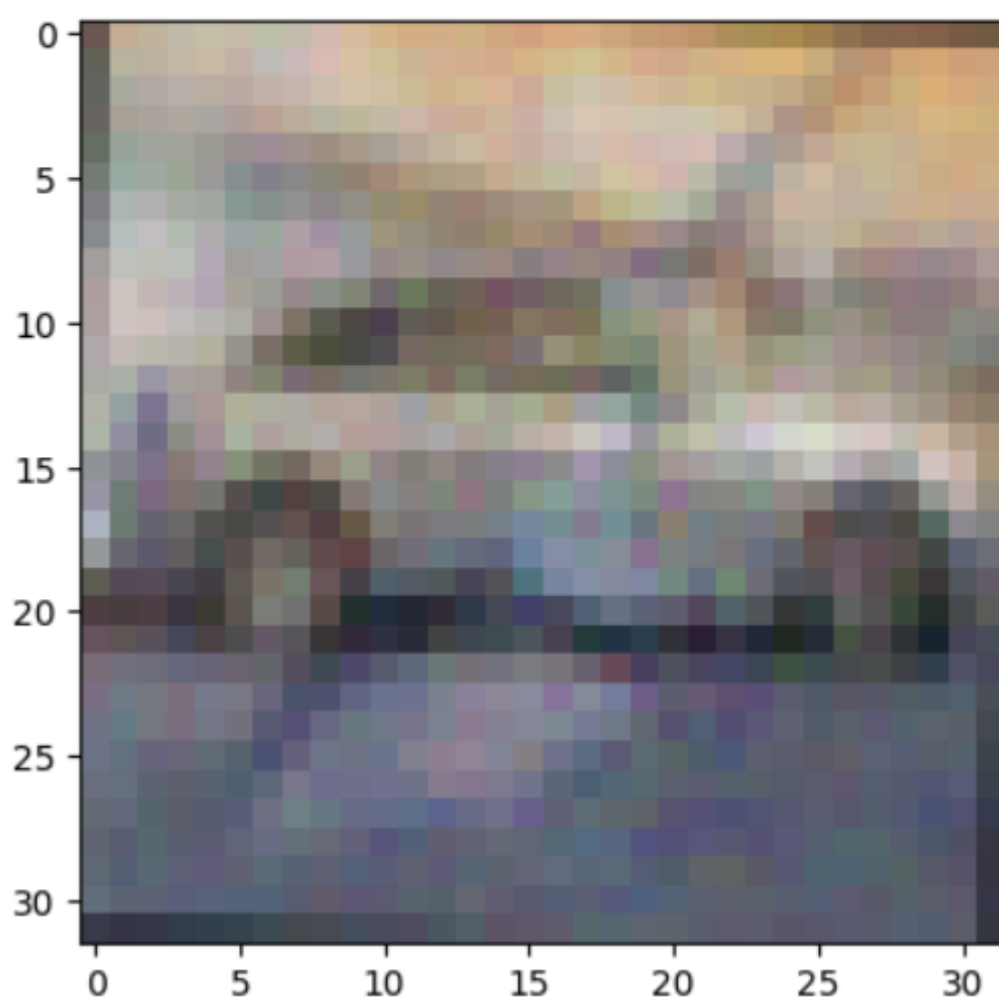
```
1/1 [=====] - 0s 30ms/step
1. automobile <-----> 0.9999799728393555
2. truck <-----> 1.9979923308710568e-05
3. bird <-----> 8.402480489166919e-09
4. horse <-----> 5.3457513971011394e-09
5. ship <-----> 2.363514273184819e-09
6. dog <-----> 1.6838390681783721e-09
7. cat <-----> 1.5494125982229434e-09
8. frog <-----> 1.1209408956602829e-09
9. airplane <-----> 5.61279668576109e-11
10. deer <-----> 2.0678200471357933e-11
```



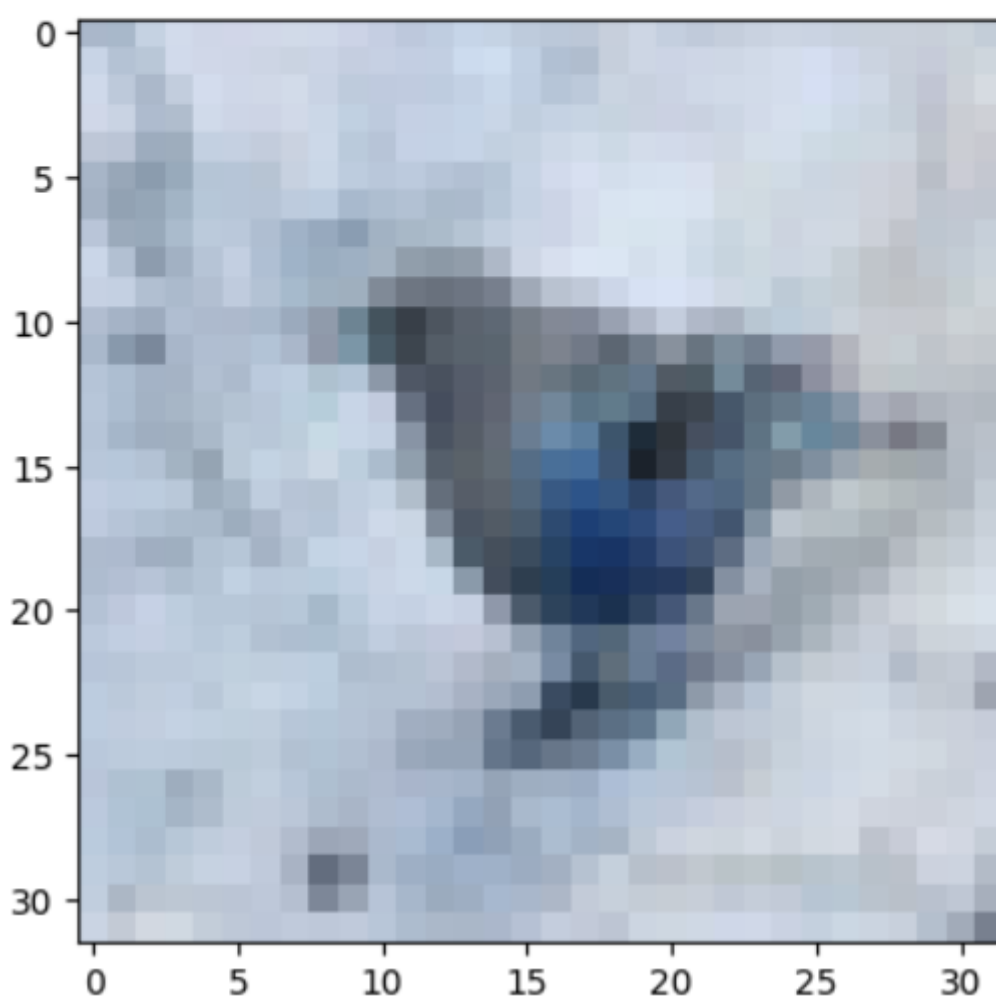
```
1/1 [=====] - 0s 22ms/step
1. automobile <-----> 0.9999994039535522
2. truck <-----> 4.2276576550648315e-07
3. ship <-----> 8.483747393484009e-08
4. dog <-----> 3.722583841181404e-08
5. bird <-----> 1.5682703136121745e-08
6. airplane <-----> 6.983343237010331e-09
7. frog <-----> 2.2569515145676178e-09
8. horse <-----> 1.7234716986891385e-09
9. deer <-----> 1.0978312703358029e-09
10. cat <-----> 7.097276100154204e-10
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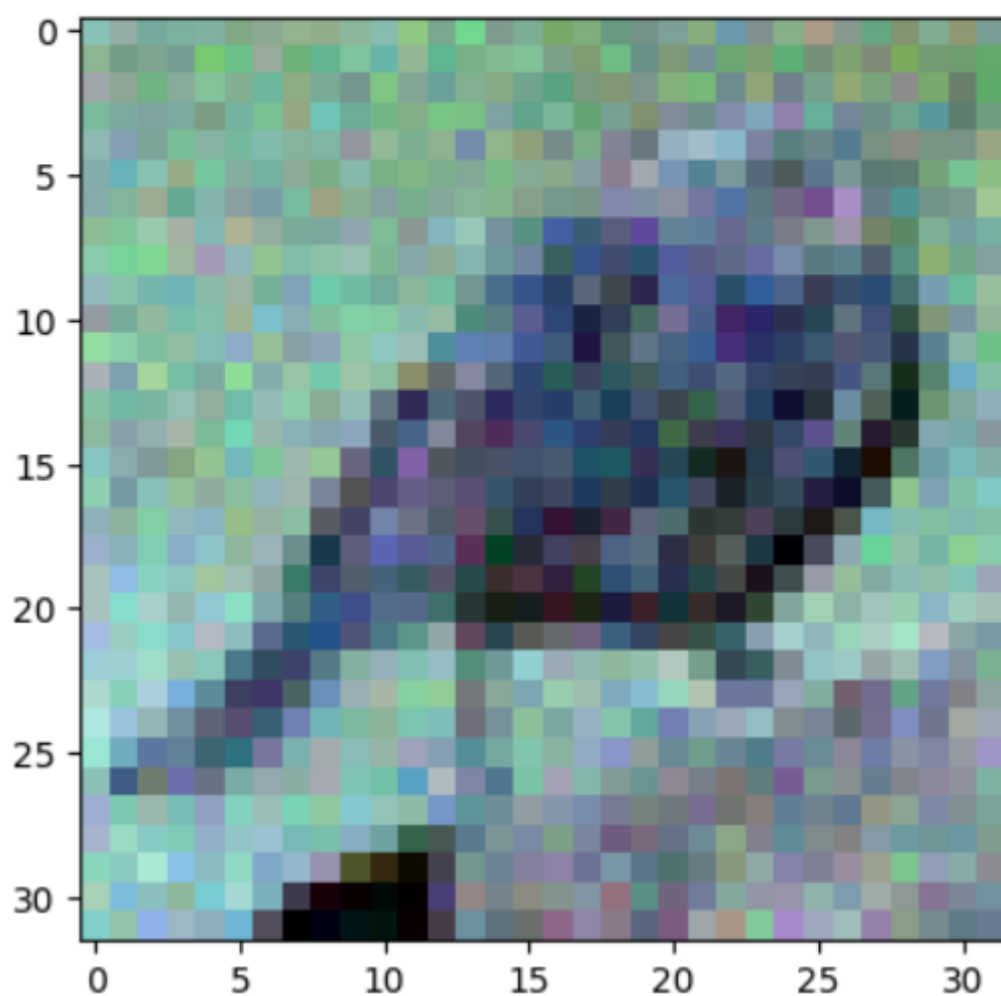
```
1/1 [=====] - 0s 21ms/step
1. ship <-----> 0.5419027209281921
2. truck <-----> 0.30117106437683105
3. airplane <-----> 0.14330370724201202
4. automobile <-----> 0.00742759695276618
5. bird <-----> 0.0033983730245381594
6. cat <-----> 0.001042767078615725
7. deer <-----> 0.0007932155858725309
8. frog <-----> 0.000777293520513922
9. dog <-----> 0.0001300451549468562
10. horse <-----> 5.322120341588743e-05
```



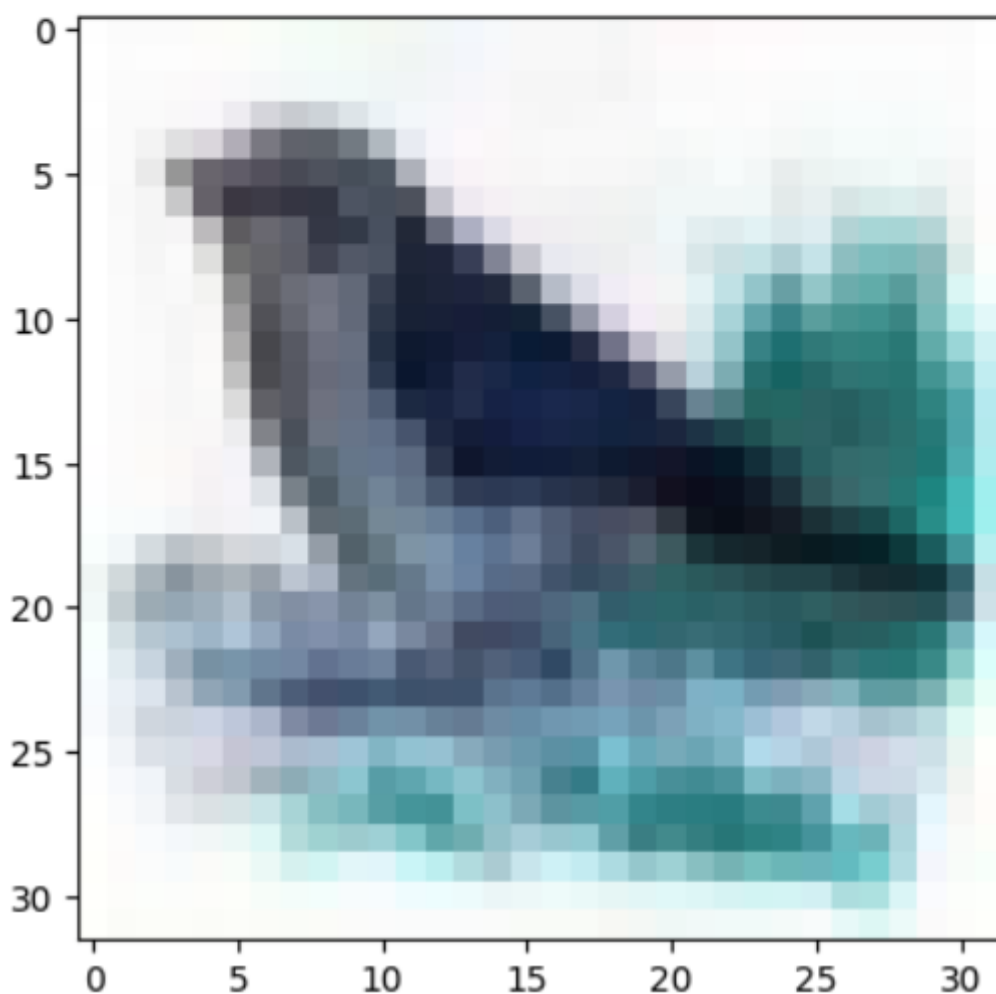

```
1/1 [=====] - 0s 21ms/step
1. bird <-----> 0.9984620809555054
2. frog <-----> 0.0014892491744831204
3. airplane <-----> 1.6882242562132888e-05
4. ship <-----> 8.712523595022503e-06
5. cat <-----> 7.402520168398041e-06
6. automobile <-----> 5.2031305131095e-06
7. dog <-----> 4.913903467240743e-06
8. deer <-----> 3.2554150948271854e-06
9. truck <-----> 2.206264298365568e-06
10. horse <-----> 6.878443059576966e-08
```



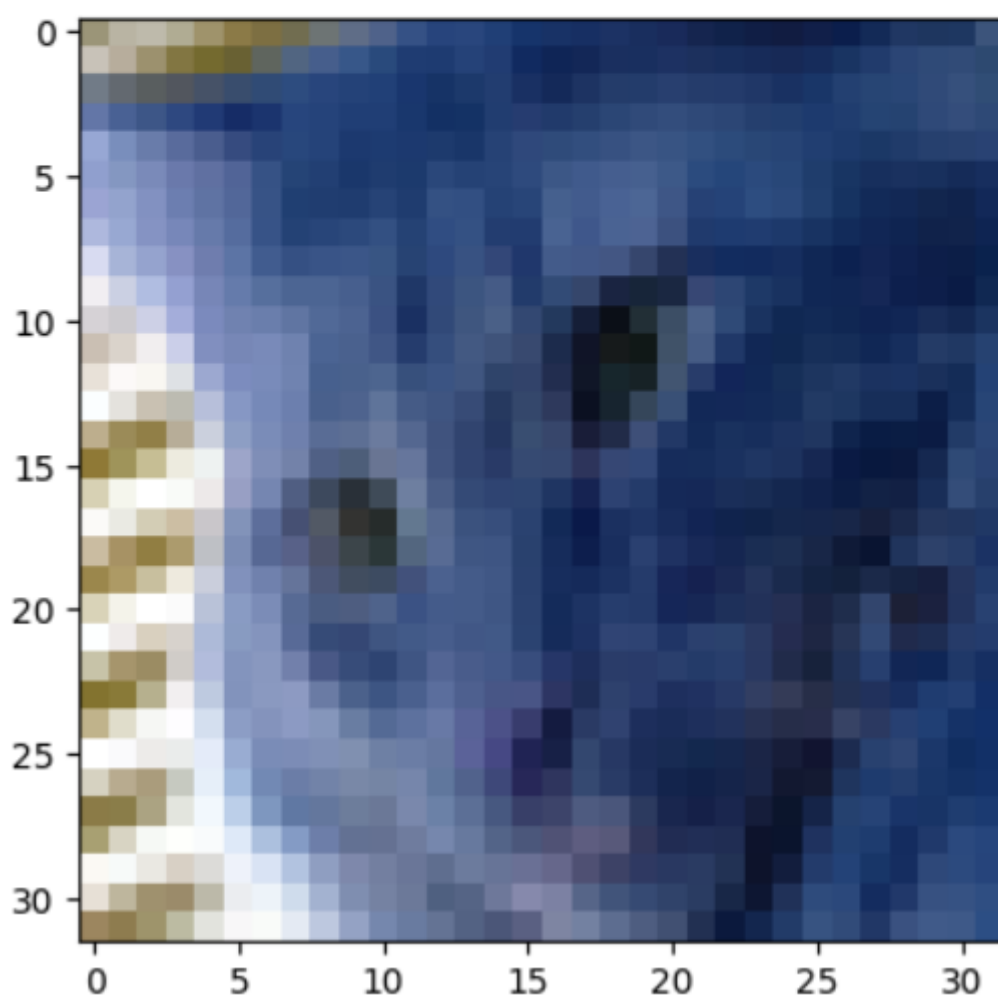
```
1/1 [=====] - 0s 22ms/step
1. dog <-----> 0.6772668361663818
2. frog <-----> 0.31107720732688904
3. bird <-----> 0.010556546039879322
4. cat <-----> 0.0006574140279553831
5. horse <-----> 0.00021941644081380218
6. deer <-----> 0.0001956356572918594
7. ship <-----> 1.465041350456886e-05
8. automobile <-----> 8.349003110197373e-06
9. airplane <-----> 3.0832829907012638e-06
10. truck <-----> 8.906927746465954e-07
```



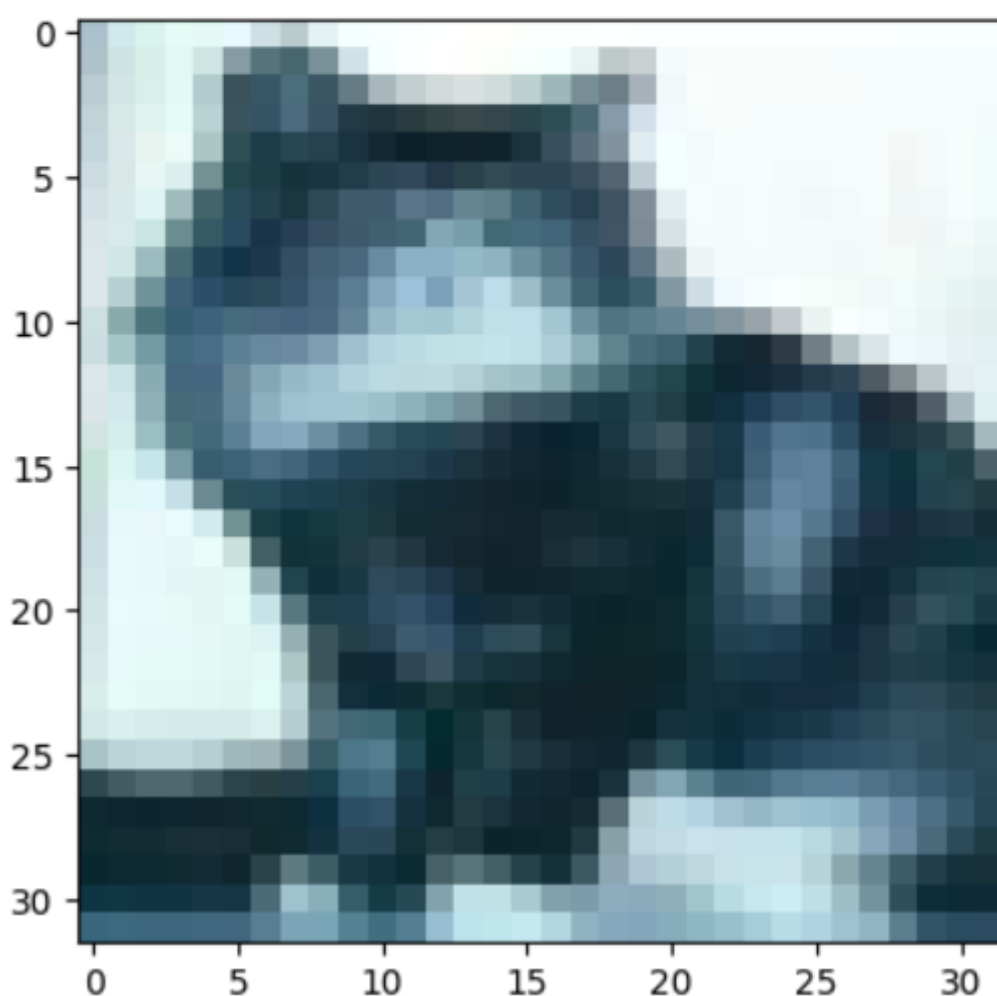
```
1/1 [=====] - 0s 21ms/step
1. bird <-----> 0.9997685551643372
2. frog <-----> 7.192071643657982e-05
3. deer <-----> 5.492728450917639e-05
4. ship <-----> 4.731357694254257e-05
5. horse <-----> 2.411467175988946e-05
6. automobile <-----> 1.4880425624141935e-05
7. cat <-----> 7.612560239067534e-06
8. truck <-----> 7.274916242749896e-06
9. dog <-----> 2.6331169920013053e-06
10. airplane <-----> 8.097822501440533e-07
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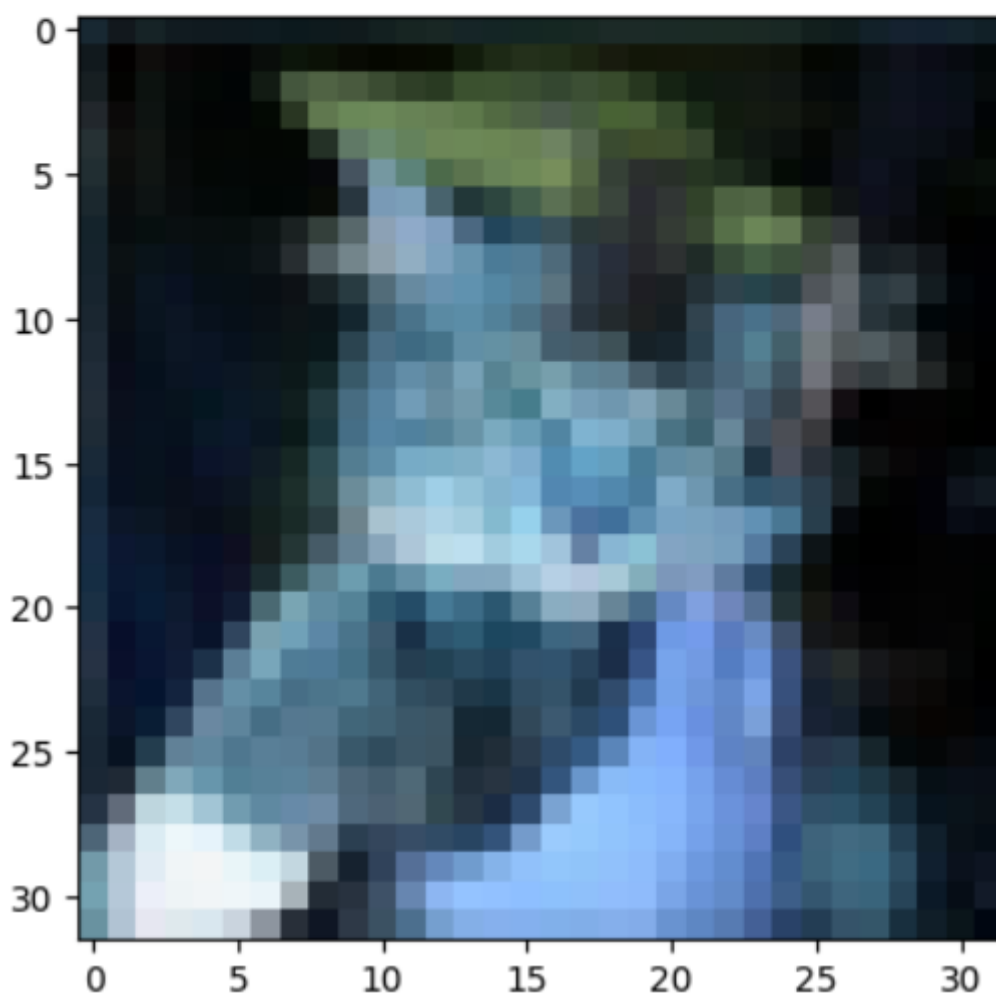
1/1 [=====] - 0s 24ms/step
1. cat <-----> 0.9915607571601868
2. dog <-----> 0.008270543068647385
3. frog <-----> 0.0001599776733200997
4. deer <-----> 4.456474925973453e-06
5. bird <-----> 2.241912625322584e-06
6. truck <-----> 9.082763199330657e-07
7. horse <-----> 8.56695578477229e-07
8. airplane <-----> 1.380578424914347e-07
9. ship <-----> 1.3659889930295321e-07
10. automobile <-----> 3.007392024301225e-08



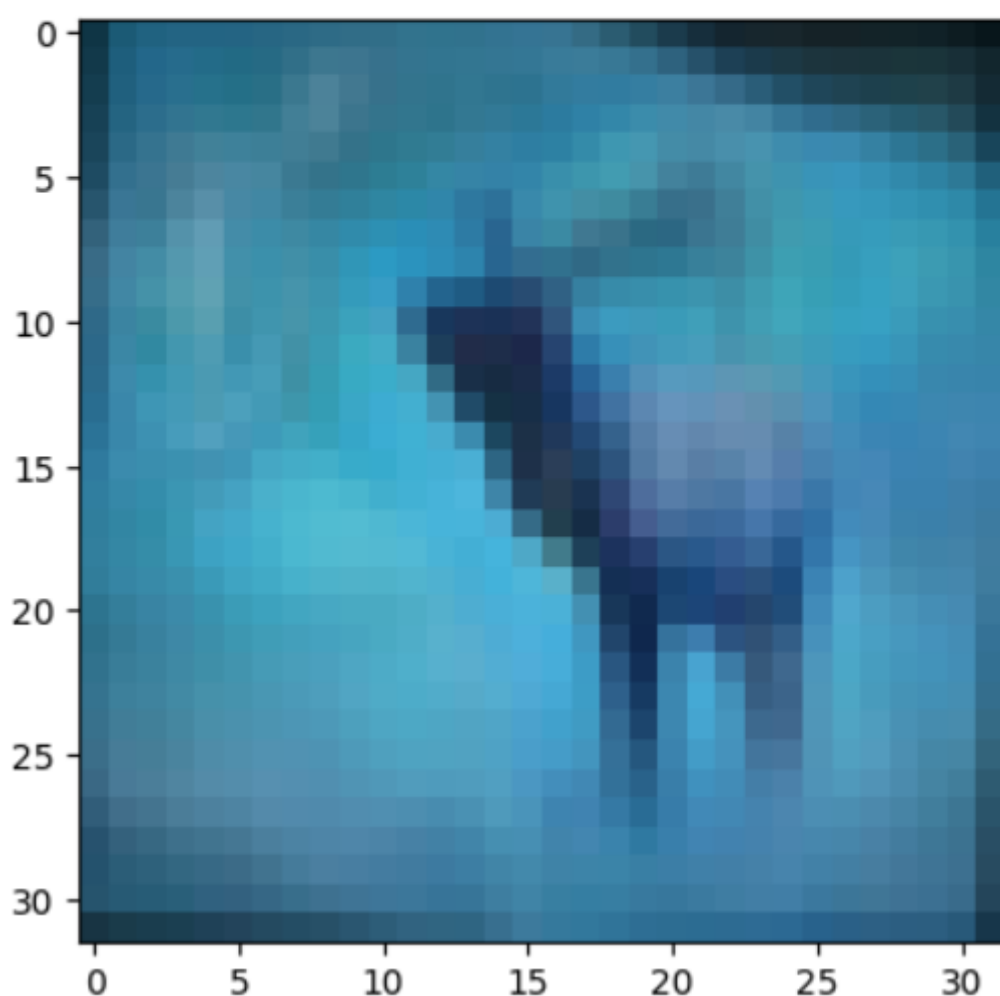
```
1/1 [=====] - 0s 21ms/step
1. cat <-----> 0.8972517251968384
2. horse <-----> 0.07608748227357864
3. dog <-----> 0.013616104610264301
4. truck <-----> 0.008694164454936981
5. bird <-----> 0.003375653875991702
6. deer <-----> 0.0005403778632171452
7. frog <-----> 0.00018726635607890785
8. automobile <-----> 0.00017680802557151765
9. ship <-----> 5.476494334288873e-05
10. airplane <-----> 1.5664090824429877e-05
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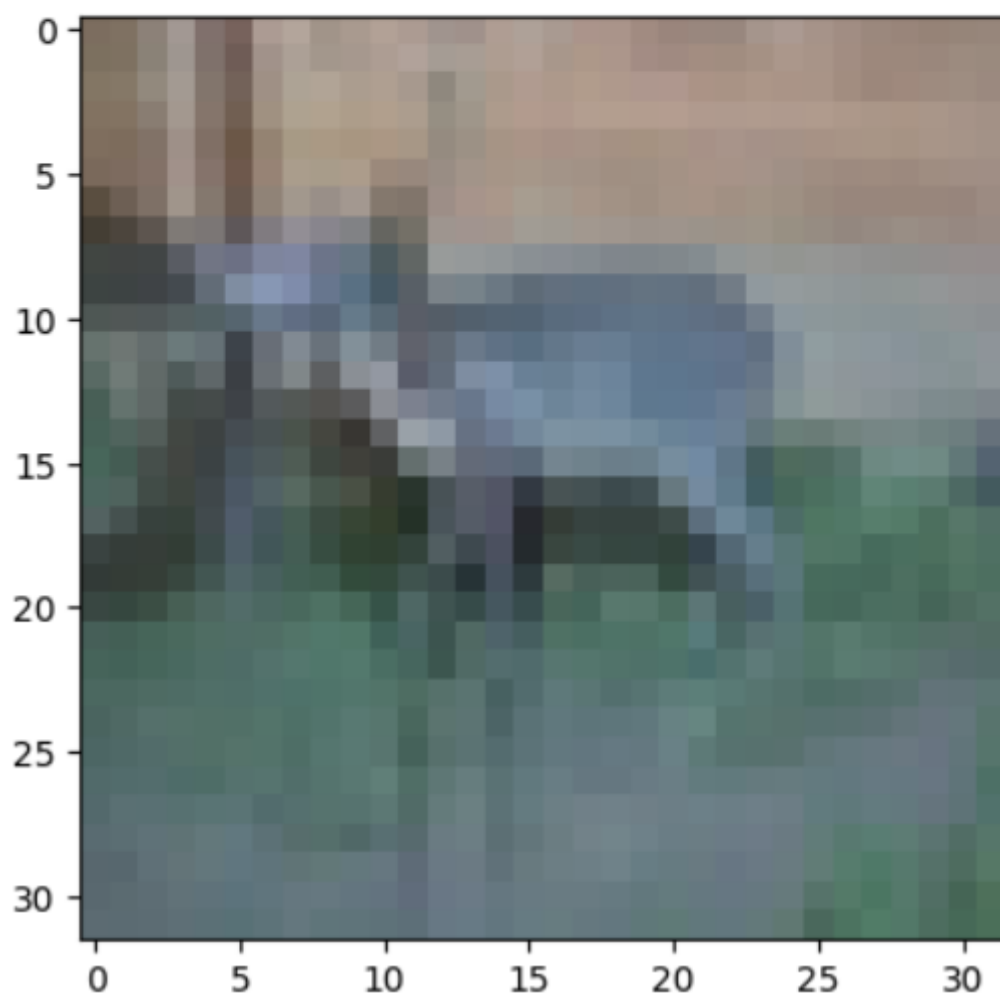
```
1/1 [=====] - 0s 23ms/step
1. frog <-----> 0.9536117911338806
2. cat <-----> 0.025260256603360176
3. bird <-----> 0.02042854018509388
4. deer <-----> 0.0003800220729317516
5. ship <-----> 0.00019357333076186478
6. dog <-----> 7.979312067618594e-05
7. truck <-----> 2.400796438450925e-05
8. airplane <-----> 1.1177674423379358e-05
9. automobile <-----> 9.43531995289959e-06
10. horse <-----> 1.4516053852275945e-06
```



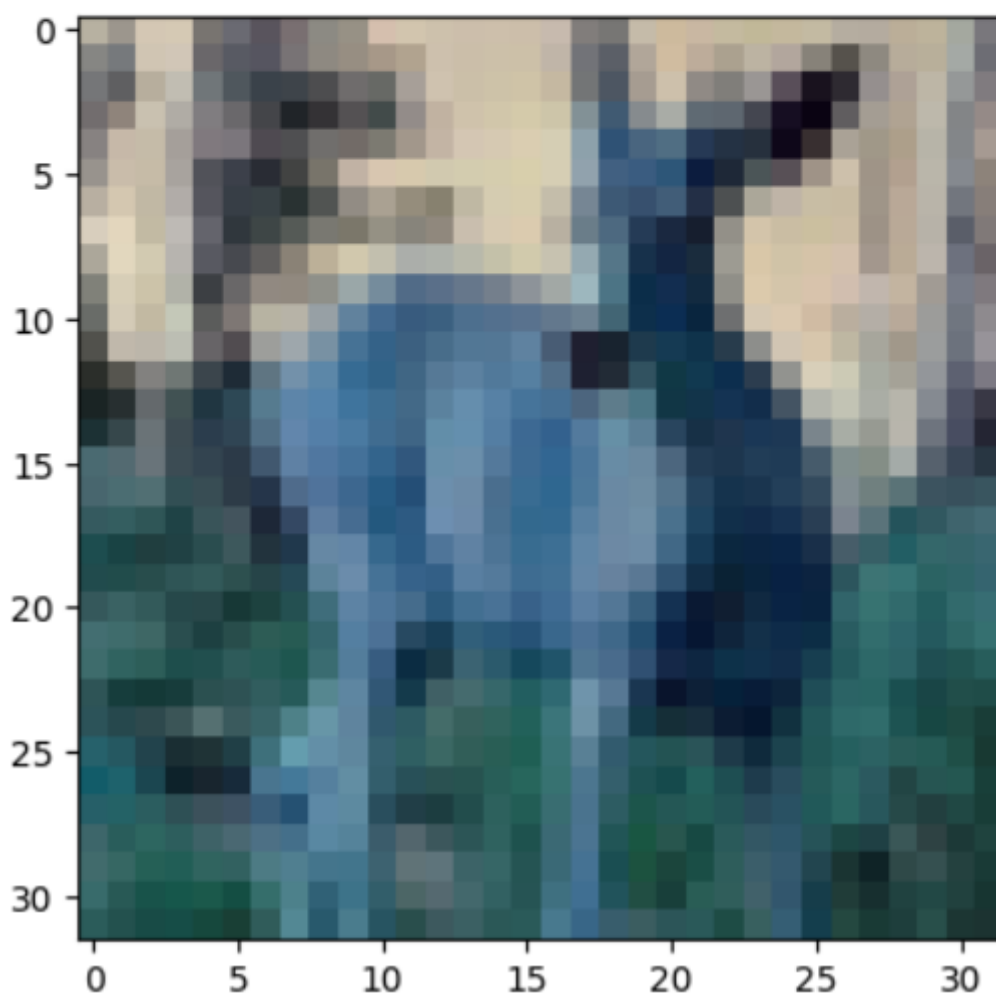
```
1/1 [=====] - 0s 36ms/step
1. deer <-----> 0.9999926090240479
2. bird <-----> 6.890912572998786e-06
3. airplane <-----> 3.3583353342692135e-07
4. horse <-----> 1.1454646653419331e-07
5. dog <-----> 4.9176776428794255e-08
6. frog <-----> 3.0614447865673355e-08
7. cat <-----> 2.5372280276769743e-08
8. ship <-----> 1.3936341858311607e-08
9. automobile <-----> 2.05223771310159e-09
10. truck <-----> 7.392305101383556e-10
```



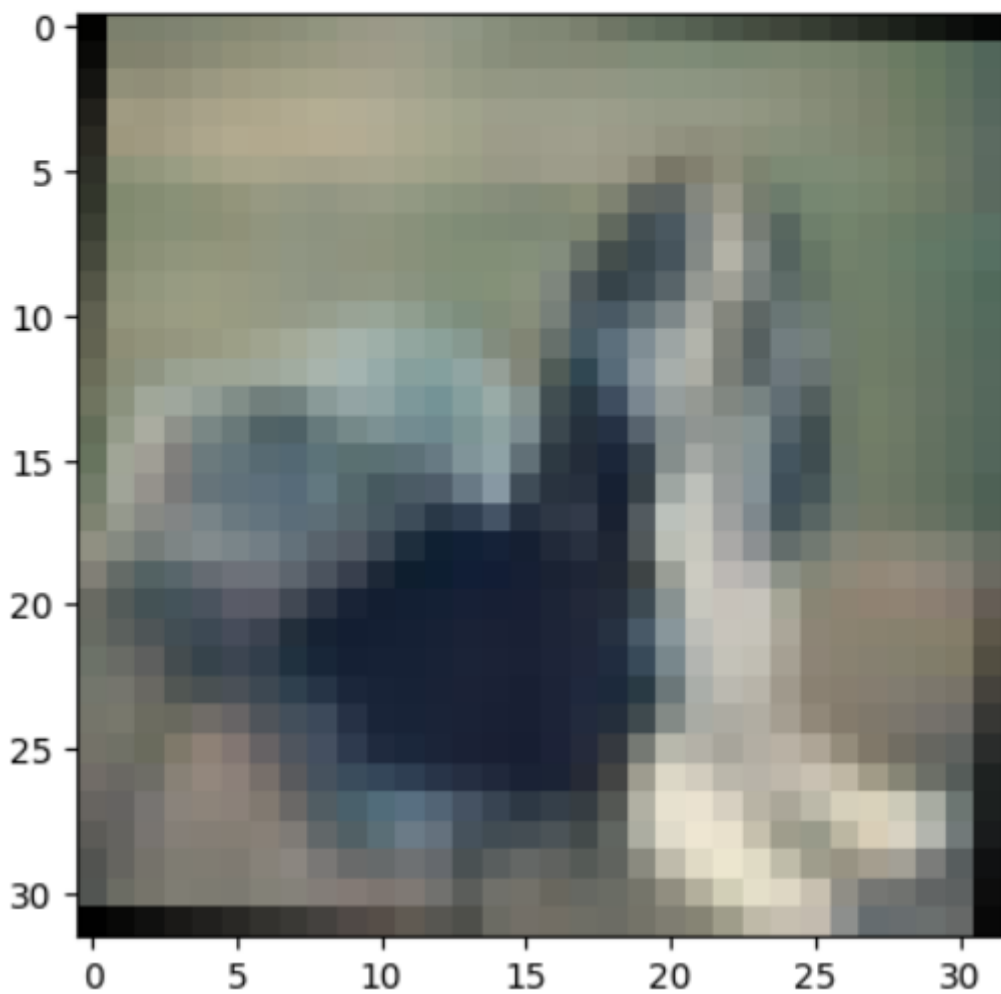
```
1/1 [=====] - 0s 22ms/step
1. deer <-----> 0.9749290943145752
2. bird <-----> 0.011442434974014759
3. horse <-----> 0.0059880162589251995
4. airplane <-----> 0.004868642892688513
5. cat <-----> 0.0013284031301736832
6. dog <-----> 0.0010926047107204795
7. truck <-----> 0.00018483090389054269
8. ship <-----> 8.35833270684816e-05
9. frog <-----> 5.6292610679520294e-05
10. automobile <-----> 2.596365266072098e-05
```



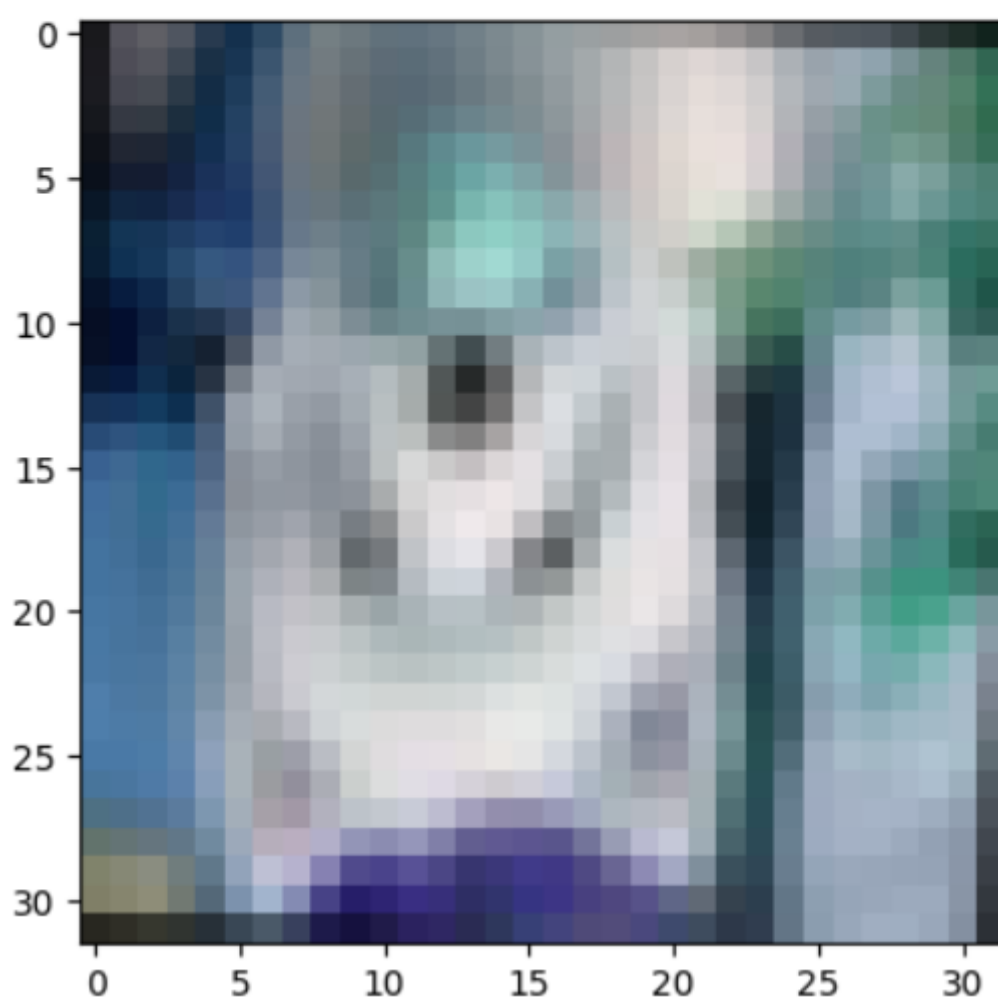

```
1/1 [=====] - 0s 22ms/step
1. deer <-----> 0.9982197880744934
2. dog <-----> 0.0010020047193393111
3. cat <-----> 0.0006981455371715128
4. frog <-----> 3.480311352177523e-05
5. horse <-----> 2.510738886485342e-05
6. bird <-----> 6.085776931286091e-06
7. airplane <-----> 5.2882519412378315e-06
8. ship <-----> 3.991108314949088e-06
9. automobile <-----> 3.5335187931195833e-06
10. truck <-----> 1.1340214314259356e-06
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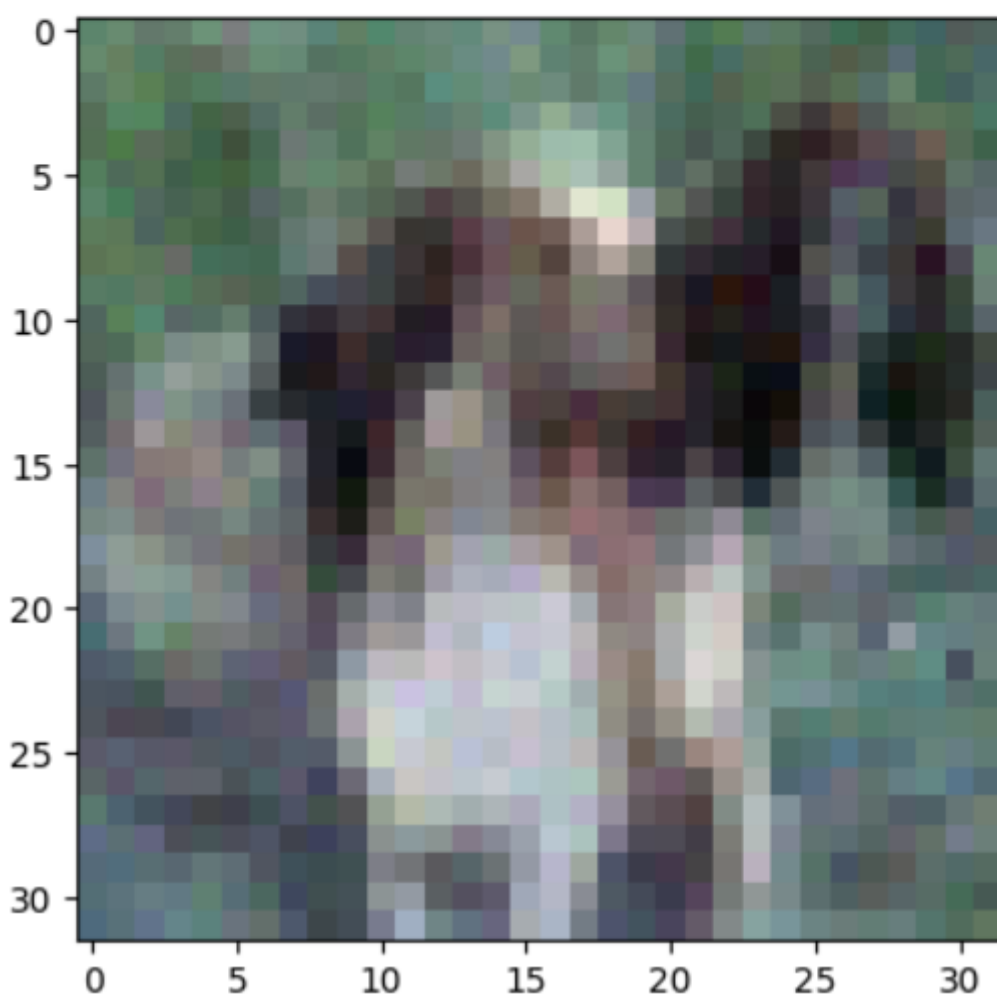
```
1/1 [=====] - 0s 23ms/step
1. dog <-----> 0.5060664415359497
2. bird <-----> 0.3379247188568115
3. cat <-----> 0.14773717522621155
4. frog <-----> 0.005751730874180794
5. deer <-----> 0.0019446138758212328
6. horse <-----> 0.0002973414084408432
7. ship <-----> 0.00019123924721498042
8. automobile <-----> 4.411334157339297e-05
9. truck <-----> 3.5001678043045104e-05
10. airplane <-----> 7.609772183059249e-06
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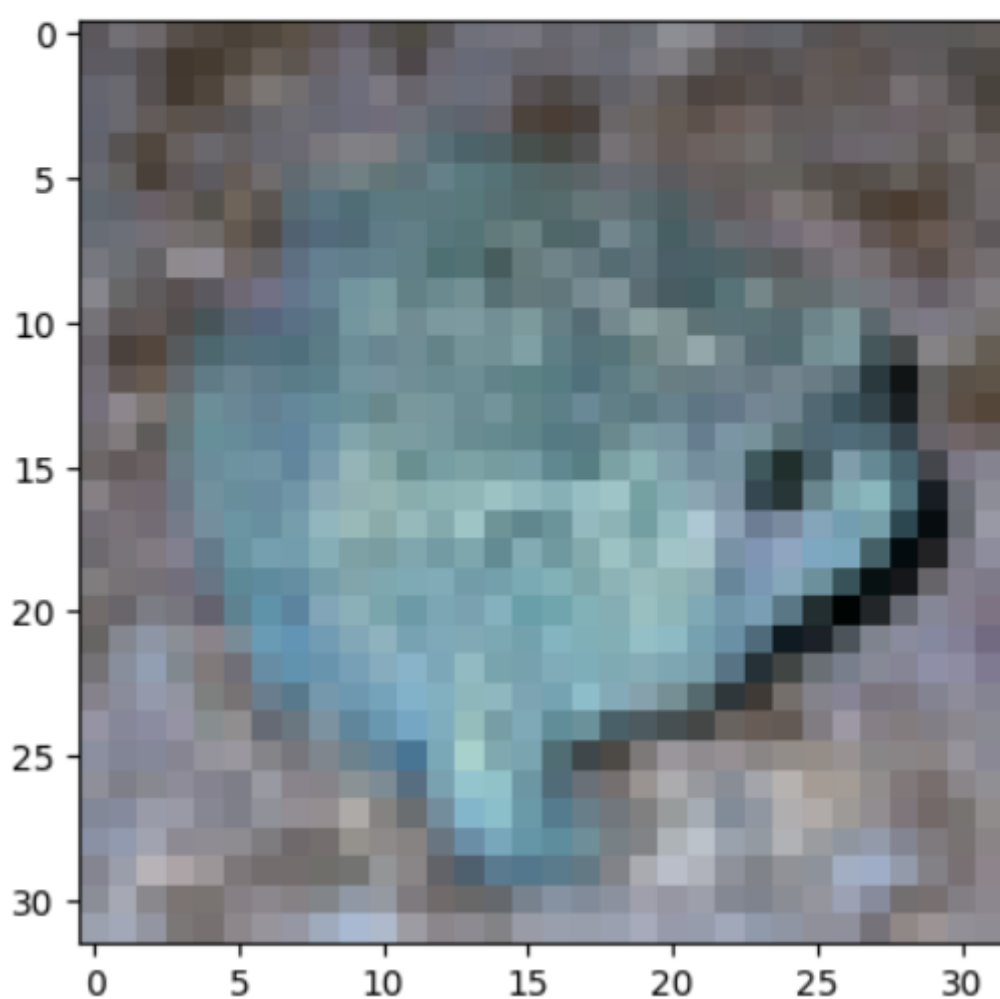
```
1/1 [=====] - 0s 23ms/step
1. dog <-----> 0.9907676577568054
2. cat <-----> 0.009219222702085972
3. horse <-----> 6.552062586706597e-06
4. bird <-----> 4.40756002717535e-06
5. deer <-----> 1.958622078745975e-06
6. ship <-----> 6.005381436580137e-08
7. frog <-----> 5.178403839067869e-08
8. automobile <-----> 3.210539745168717e-08
9. airplane <-----> 1.7242467009737084e-08
10. truck <-----> 1.3375200502707685e-08
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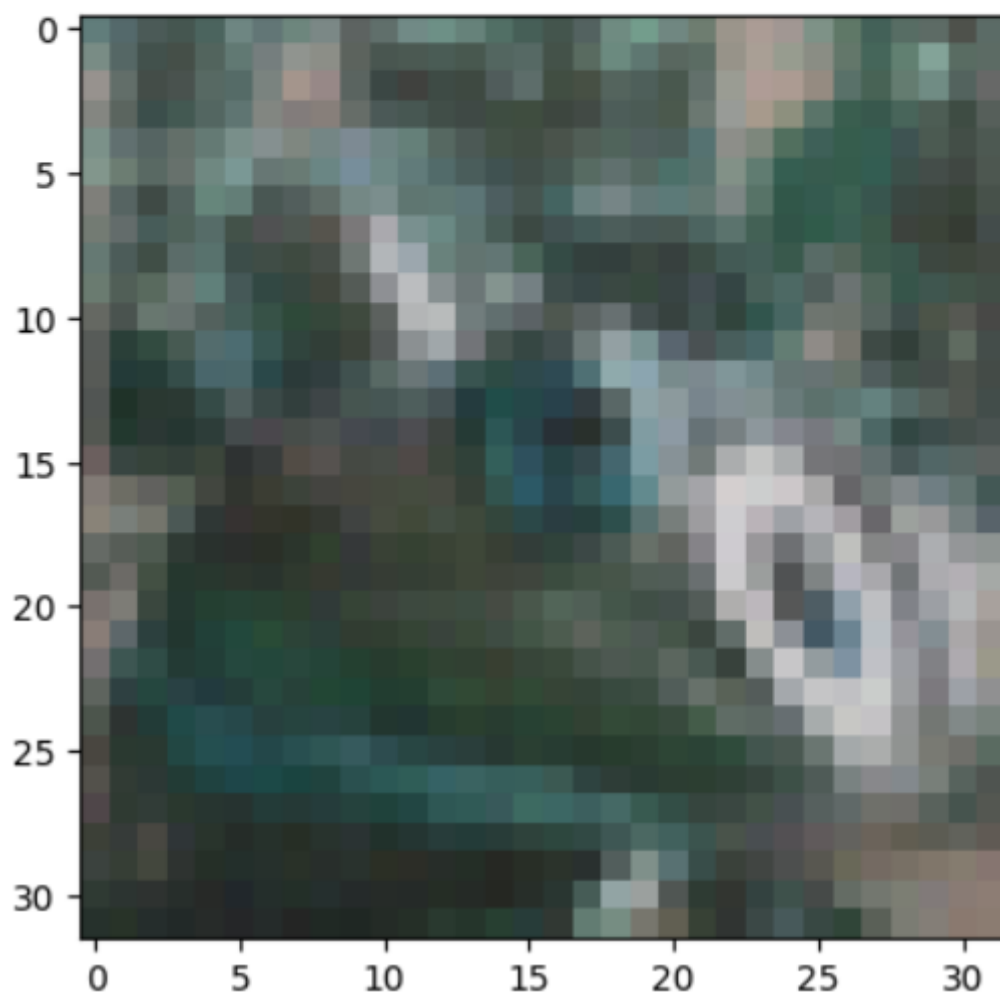
```
1/1 [=====] - 0s 20ms/step
1. dog <-----> 0.9964413046836853
2. cat <-----> 0.0017431366723030806
3. horse <-----> 0.0011382130905985832
4. deer <-----> 0.0003837765543721616
5. bird <-----> 0.00017480584210716188
6. frog <-----> 6.676825432805344e-05
7. airplane <-----> 2.8386035410221666e-05
8. truck <-----> 9.20431011763867e-06
9. ship <-----> 8.343513400177471e-06
10. automobile <-----> 6.017642135702772e-06
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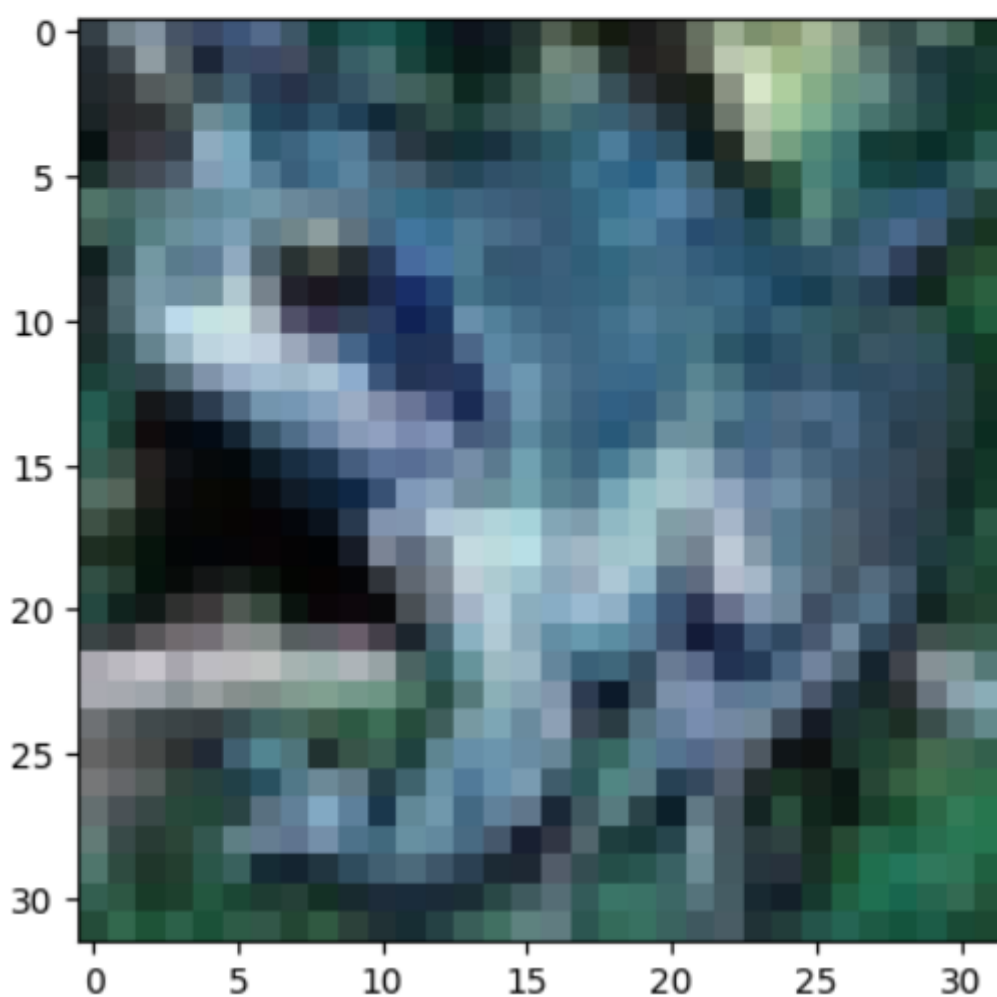
```
1/1 [=====] - 0s 23ms/step
1. frog <-----> 0.999993085861206
2. bird <-----> 5.391391823650338e-06
3. deer <-----> 9.368333167003584e-07
4. cat <-----> 4.6183782842490473e-07
5. ship <-----> 8.509396565159477e-08
6. airplane <-----> 2.0443009063342288e-08
7. horse <-----> 8.497795356277038e-09
8. truck <-----> 6.571962085644145e-09
9. automobile <-----> 4.609204129479849e-09
10. dog <-----> 1.5666509201039958e-09
```



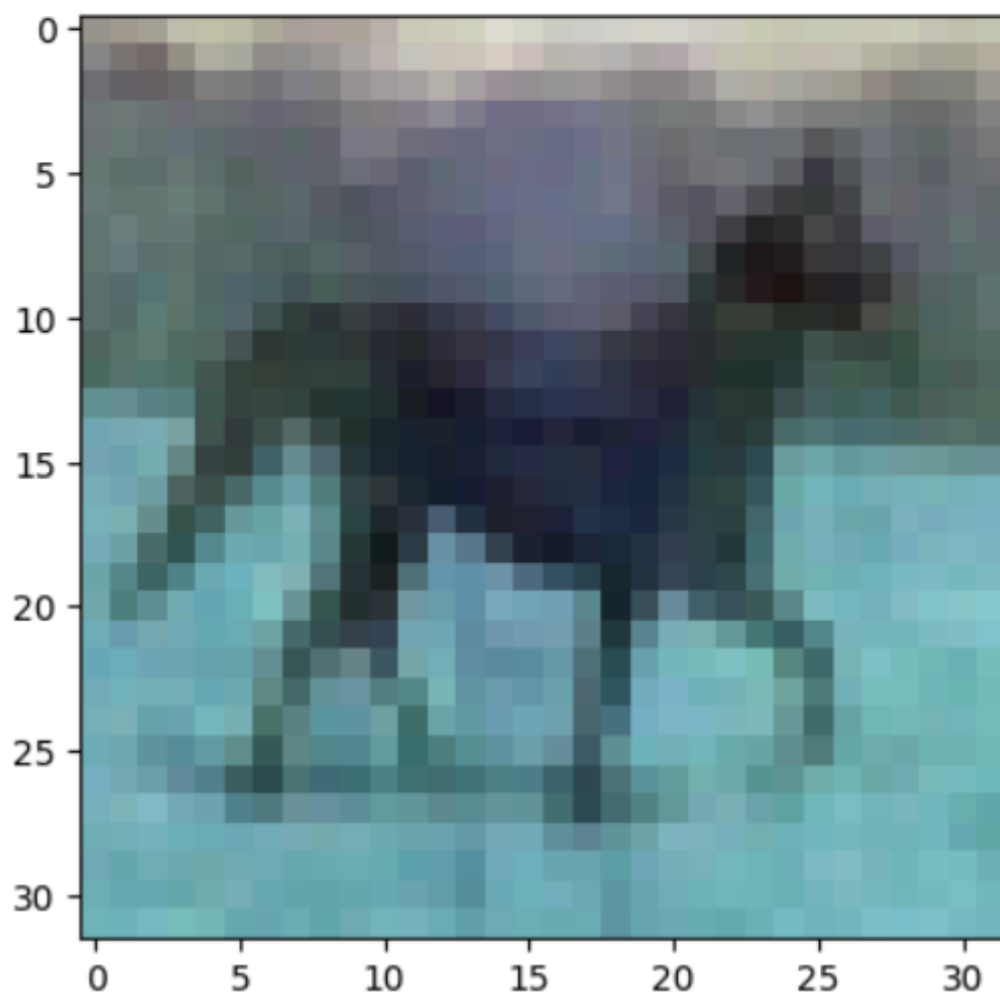
```
1/1 [=====] - 0s 23ms/step
1. bird <-----> 0.36728188395500183
2. deer <-----> 0.3248750567436218
3. frog <-----> 0.2568531036376953
4. airplane <-----> 0.04281775280833244
5. ship <-----> 0.003962182905524969
6. automobile <-----> 0.002644109074026346
7. cat <-----> 0.0013144598342478275
8. dog <-----> 0.00011212220852030441
9. truck <-----> 0.00010997747449437156
10. horse <-----> 2.9311569960555062e-05
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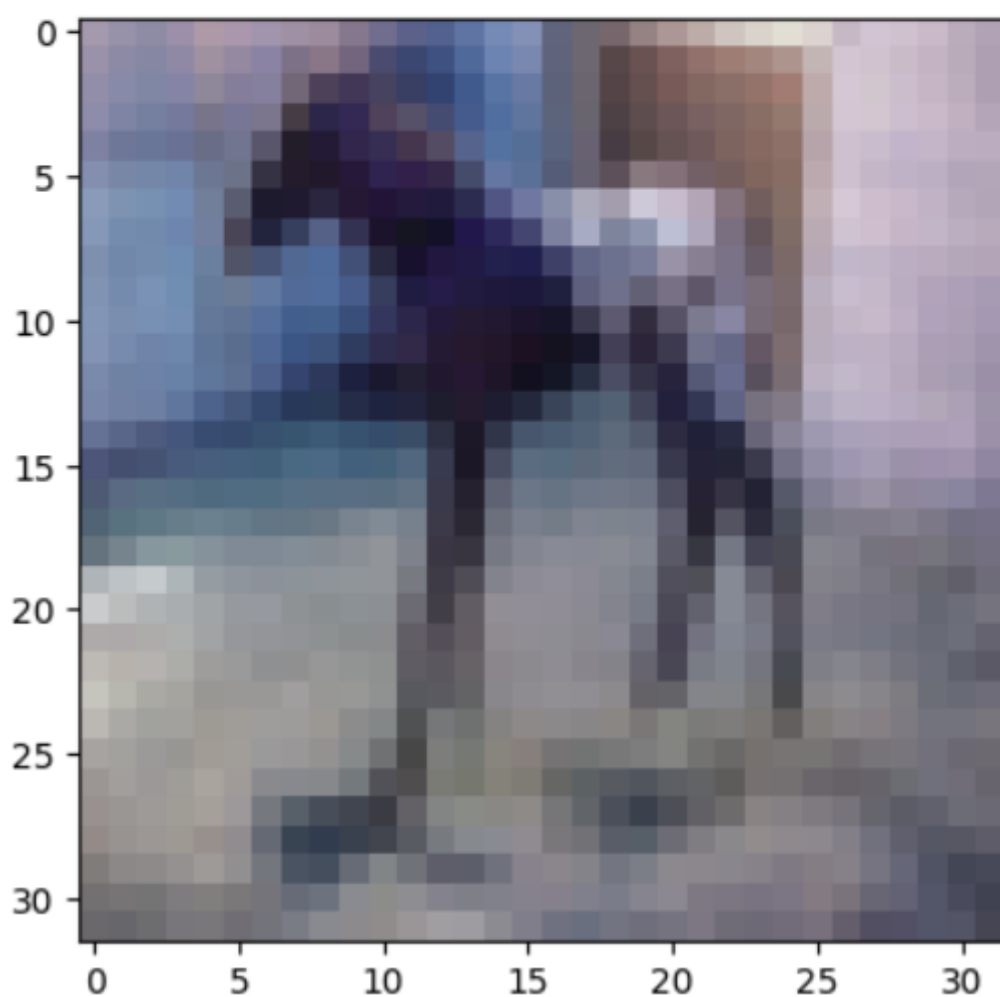
```
1/1 [=====] - 0s 30ms/step
1. frog <-----> 0.9999997615814209
2. deer <-----> 1.282177772842324e-07
3. bird <-----> 6.799679397317959e-08
4. cat <-----> 1.1266352295535853e-08
5. truck <-----> 8.171322285477345e-09
6. horse <-----> 5.744452913347686e-09
7. automobile <-----> 9.95469817688388e-10
8. dog <-----> 6.522886675242034e-10
9. ship <-----> 2.6056348745306934e-10
10. airplane <-----> 2.47118520091405e-10
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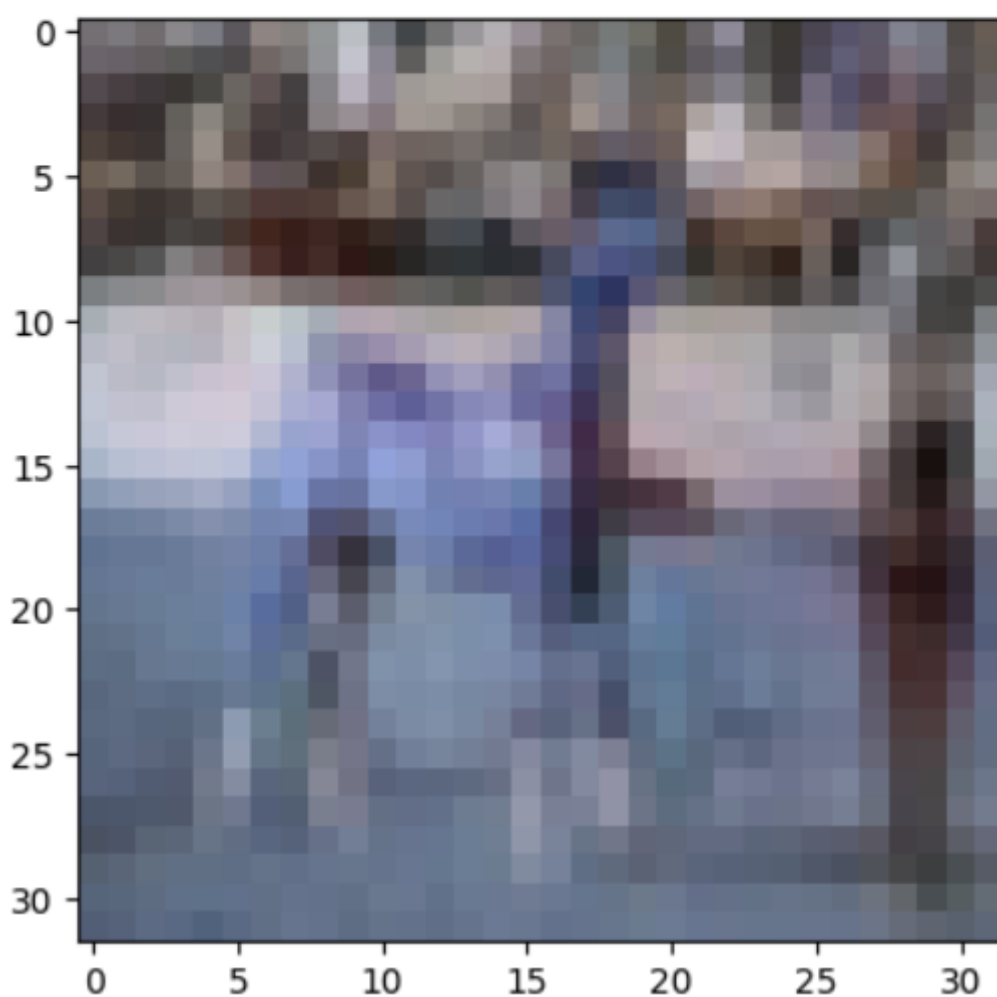
```
1/1 [=====] - 0s 21ms/step
1. horse <-----> 0.999993085861206
2. bird <-----> 2.7025159852200886e-06
3. dog <-----> 2.353669515287038e-06
4. deer <-----> 1.5260043255693745e-06
5. airplane <-----> 1.7818921094203688e-07
6. cat <-----> 7.86024472176905e-08
7. truck <-----> 1.3615902183516937e-08
8. ship <-----> 1.166544016939497e-08
9. automobile <-----> 6.644638173014528e-09
10. frog <-----> 5.54386669904261e-09
```



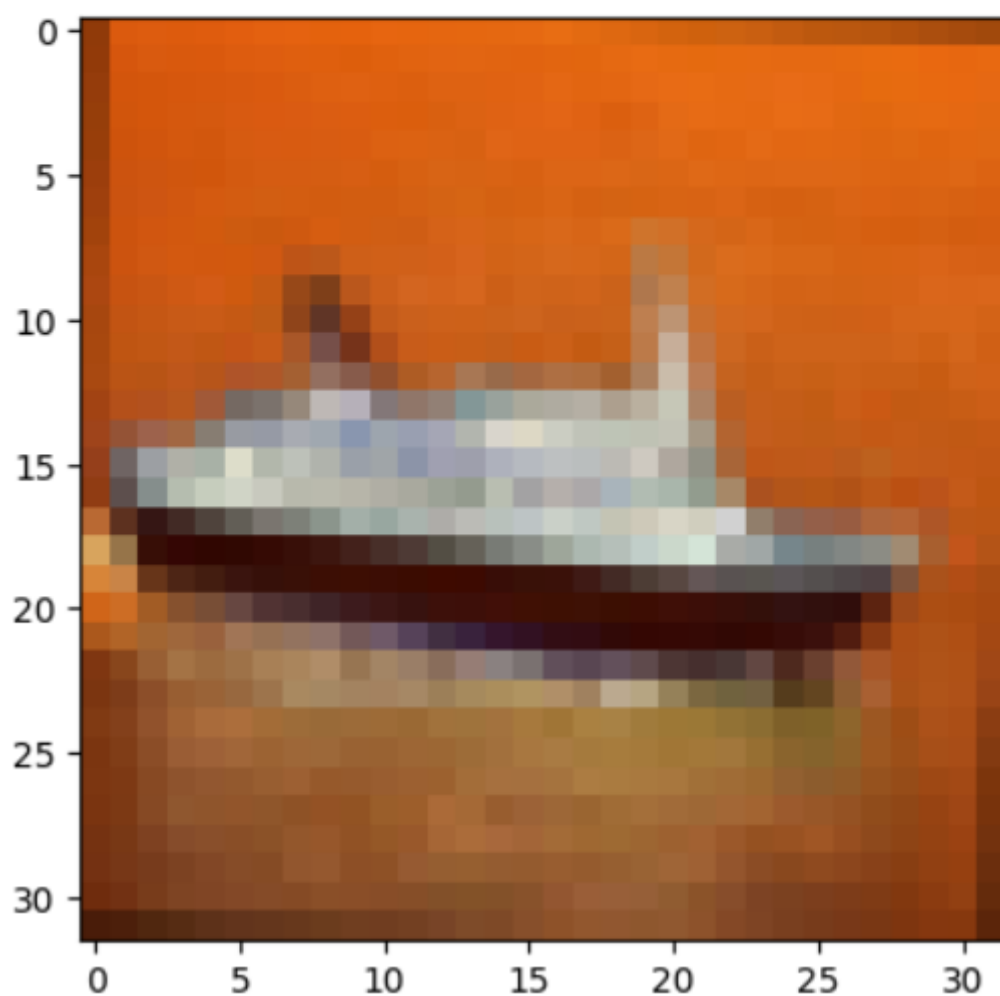
1/1 [=====] - 0s 21ms/step
1. horse <-----> 0.5627070069313049
2. cat <-----> 0.34900981187820435
3. dog <-----> 0.045745160430669785
4. truck <-----> 0.014910649508237839
5. deer <-----> 0.01073144655674696
6. bird <-----> 0.008985752239823341
7. ship <-----> 0.004434624686837196
8. automobile <-----> 0.0015018009580671787
9. frog <-----> 0.0014952741330489516
10. airplane <-----> 0.0004783973563462496



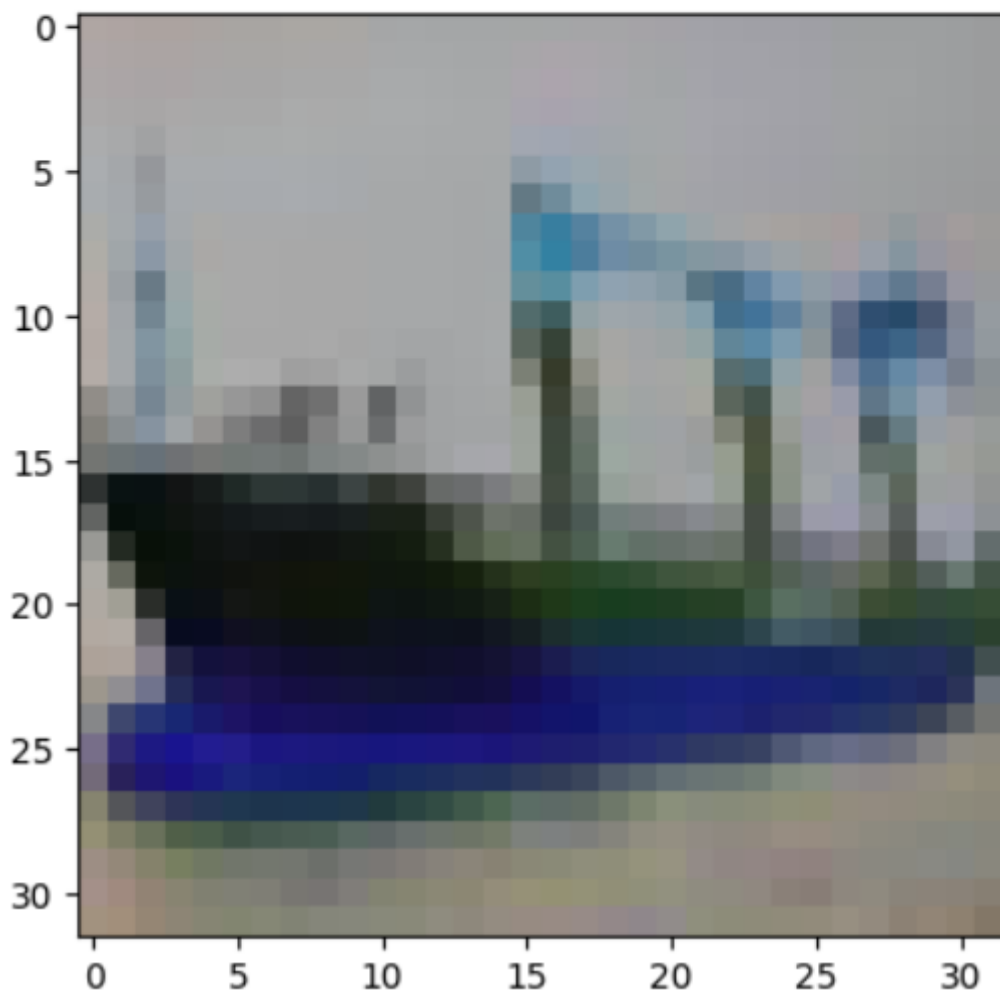
```
1/1 [=====] - 0s 22ms/step
1. deer <-----> 0.9624949097633362
2. horse <-----> 0.03727750480175018
3. dog <-----> 0.00010729012137744576
4. bird <-----> 8.01572750788182e-05
5. cat <-----> 3.858144555124454e-05
6. airplane <-----> 9.402263572155789e-07
7. ship <-----> 3.345728316617169e-07
8. truck <-----> 1.1777654407296723e-07
9. automobile <-----> 1.1150975609552916e-07
10. frog <-----> 9.59624557594907e-08
```



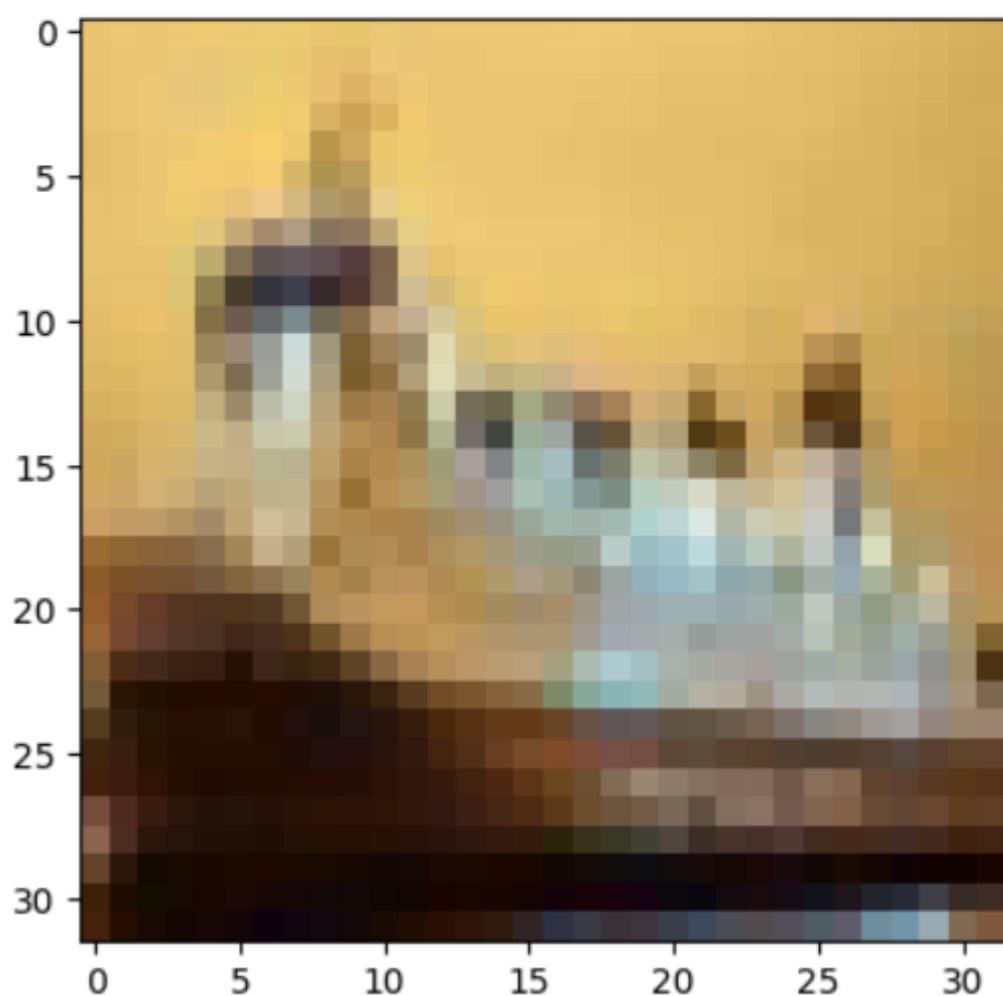
```
1/1 [=====] - 0s 21ms/step
1. ship <-----> 0.9999796152114868
2. airplane <-----> 1.8903565432992764e-05
3. truck <-----> 8.113393619169074e-07
4. bird <-----> 3.7793986962242343e-07
5. frog <-----> 5.998526120265524e-08
6. deer <-----> 5.8861516549768567e-08
7. cat <-----> 5.770982269837077e-08
8. horse <-----> 1.703811491893248e-08
9. dog <-----> 1.0500261993229287e-08
10. automobile <-----> 8.515999461167212e-09
```



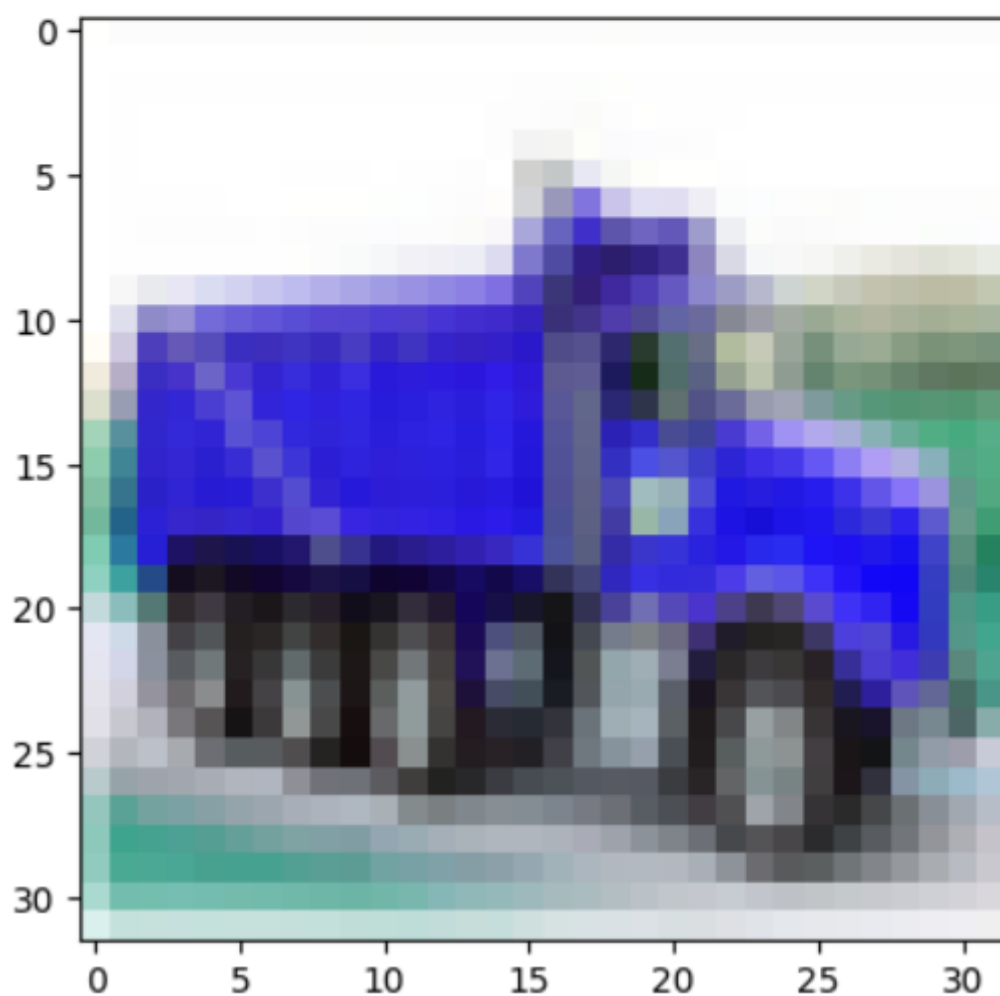
```
1/1 [=====] - 0s 21ms/step
1. ship <-----> 0.9998997449874878
2. truck <-----> 8.404716209042817e-05
3. cat <-----> 4.369748694443842e-06
4. airplane <-----> 3.664022869998007e-06
5. automobile <-----> 3.5063626455666963e-06
6. bird <-----> 2.480838702467736e-06
7. dog <-----> 9.758281294125482e-07
8. frog <-----> 7.863607720537402e-07
9. deer <-----> 2.2190013737599656e-07
10. horse <-----> 1.762614800782103e-07
```



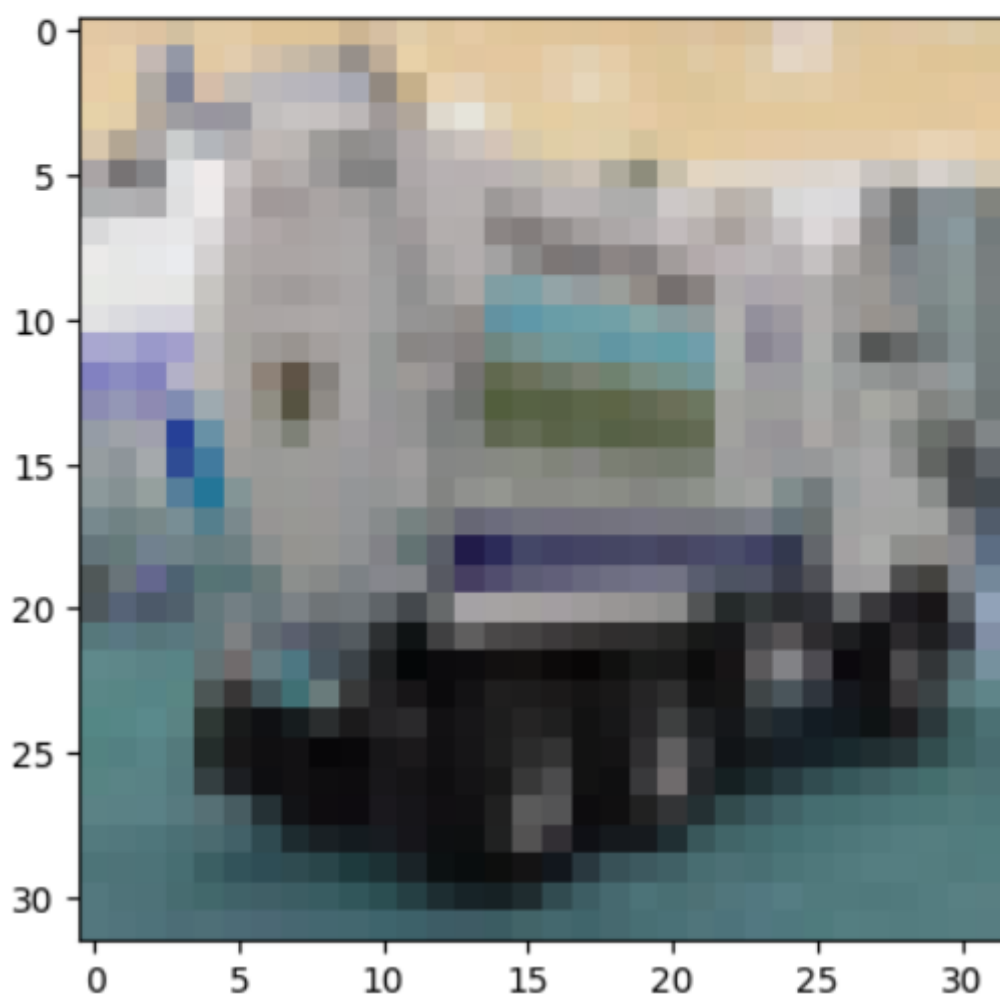
```
1/1 [=====] - 0s 20ms/step
1. ship <-----> 0.9983137845993042
2. airplane <-----> 0.0016527896514162421
3. truck <-----> 2.5640110834501684e-05
4. bird <-----> 4.77140338261961e-06
5. automobile <-----> 1.2052186093569617e-06
6. deer <-----> 8.448895414403523e-07
7. horse <-----> 7.063512157401419e-07
8. frog <-----> 2.780697911930474e-07
9. cat <-----> 9.802081279985941e-08
10. dog <-----> 5.2217075108274e-08
```



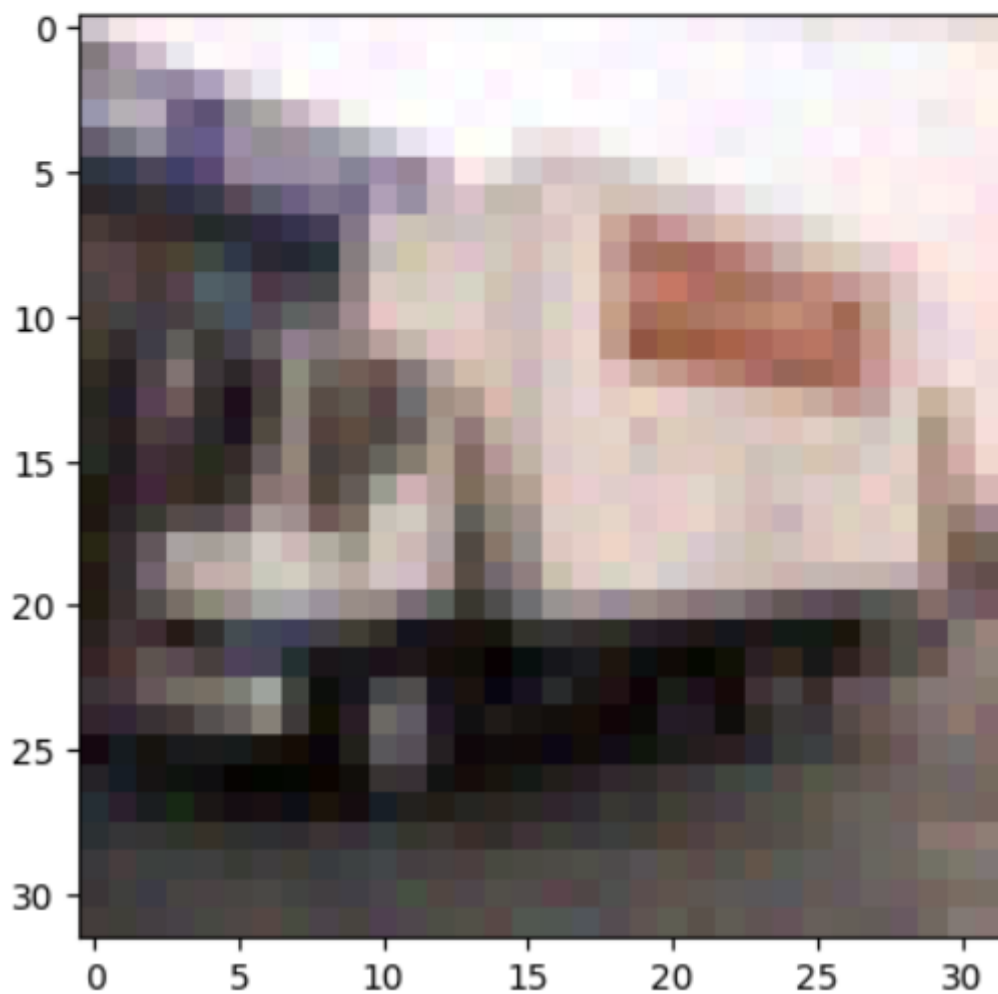
```
1/1 [=====] - 0s 32ms/step
1. truck <-----> 0.9999337196350098
2. horse <-----> 6.263669638428837e-05
3. automobile <-----> 3.5091779864160344e-06
4. cat <-----> 2.45525427544635e-07
5. bird <-----> 4.031292633044359e-08
6. deer <-----> 1.8083494701670588e-09
7. frog <-----> 1.7249961459242513e-09
8. ship <-----> 1.473931643403148e-09
9. dog <-----> 1.0833982599933734e-09
10. airplane <-----> 3.4915453861472656e-10
```

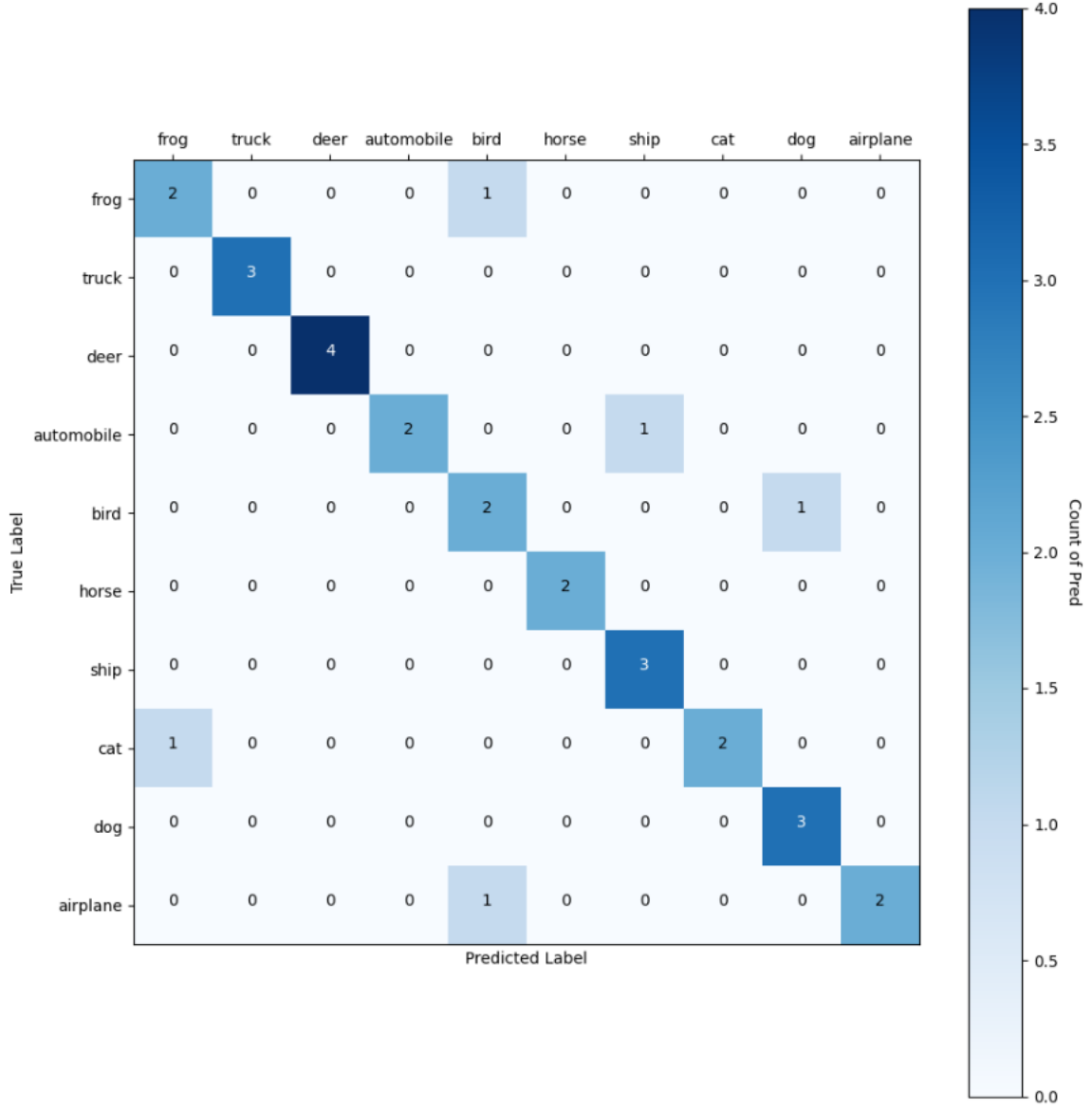


```
1/1 [=====] - 0s 22ms/step
1. truck <-----> 0.9999979734420776
2. automobile <-----> 1.995460252146586e-06
3. ship <-----> 6.475435188058043e-10
4. deer <-----> 6.081357084575245e-10
5. horse <-----> 5.100914690636671e-10
6. frog <-----> 1.6880070952129955e-10
7. airplane <-----> 1.2315874708956898e-10
8. cat <-----> 9.552287433267637e-11
9. bird <-----> 3.825138816804241e-11
10. dog <-----> 2.490185835313241e-11
```



```
1/1 [=====] - 0s 22ms/step
1. truck <-----> 0.9999995231628418
2. automobile <-----> 4.6721041258024343e-07
3. airplane <-----> 4.300371259091662e-08
4. ship <-----> 4.196884972884618e-08
5. dog <-----> 1.0485554646777473e-09
6. horse <-----> 6.437049226981628e-10
7. cat <-----> 4.4212297711787585e-10
8. bird <-----> 1.8953300040536192e-10
9. frog <-----> 1.0939053829428502e-10
10. deer <-----> 9.27570780601128e-12
```





Test Durumları Karışıklık Matrisi

SONUÇ

3 katmanlı 3x3 kernelli konvolüsyon katmanları ve değişik parametreleri kullandığımda genelde daha az validation score elde ettiğimizi gördüm bu sınıflandırma işlemi için daha çok katmanlı bir mimari daha iyi sonuçlar getiriyor diye düşünüyorum. Belki az katmanlı mimariler için tur sayısı artırılarak belli oranda iyileşme sağlanabilir ama bir müddet sonra model overfit olacaktır.

Deep learning günümüzde insanları feature extraction işlemlerini yapmaktan kurtarıyor. Bu da CNN ve transfer learning mantığının çok iyi işe yaradığı yerlerden biri. Özellikle CNN ile nesne sınıflandırmada büyük başarılar elde edilebiliyor. Tabi bunlar kullanılan veri setlerine, görüntünün içeriğine de bağlı. Bu proje özelinde multiclass classification yaparak 10 sınıf için görüntü sınıflandırma yapıyoruz ve başarı oranının yüksek olduğunu düşünüyorum.