

Chi-Squared Histogram Matching

In this report, I have used chi-squared histogram matching to compare color histograms that are produced from various images. Overall performance was between 24%-30% and a lot of categories had lower than 10% success rate. This is mostly due to high variance inside the categories. Using intersection formula had between 20%-25% success rate. Therefore, using chi-squared comparison was one of the factors that increased the overall performance.

Some of the categories like Leopards, car_side always have a high (>70.0%) success rate, it's because these images have almost the same angles and illumination levels. For example car_side category mostly consists of grayscale images and that makes it easily recognizable by color histograms.

Using 2x2 grid increased the overall performance as well as some of the hard-to-recognize categories. For example stapler category has images that contain an object from various angles with different illumination levels. All of the single cell tests have 0% success on that category while 2x2 grid was able to recognize 2-3 of them. Therefore, using 2x2 grid definitely increased overall performance along with hard categories.

In single cell histograms, increasing quantization level decreases the overall performance. It is probably due to that we have a large dataset in various resolutions and recognizing a particular image as a whole will require more information.

I have provided outputs with different parameters (quantization, grid size) below.

-- Single Cell Histograms

Quantization Level : 1

BACKGROUND_Google - 10.256411%
Faces - 36.238533%
Faces_easy - 50.000000%
Leopards - 89.000000%
Motorbikes - 83.208023%
accordion - 35.714287%
airplanes - 62.750000%
anchor - 14.285714%
ant - 14.285714%
barrel - 8.333333%
bass - 0.000000%
beaver - 0.000000%
binocular - 0.000000%
bonsai - 14.062500%
brain - 24.489796%
brontosaurus - 0.000000%
buddha - 4.651163%
butterfly - 8.695652%
camera - 8.000000%
cannon - 9.090909%
car_side - 74.193550%
ceiling_fan - 12.500000%

cellphone - 40.000000%
chair - 3.225806%
chandelier - 5.555555%
cougar_body - 12.500000%
cougar_face - 11.428572%
crab - 5.405406%
crayfish - 0.000000%
crocodile - 4.000000%
crocodile_head - 0.000000%
cup - 3.448276%
dalmatian - 8.823529%
dollar_bill - 23.076923%
dolphin - 15.151515%
dragonfly - 0.000000%
electric_guitar - 7.894737%
elephant - 3.125000%
emu - 3.703704%
euphonium - 28.125000%
ewer - 2.325581%
ferry - 5.882353%
flamingo - 14.705882%
flamingo_head - 0.000000%
garfield - 41.176472%
gerenuk - 5.882353%
gramophone - 3.846154%
grand_piano - 16.000000%
hawksbill - 26.000000%
headphone - 9.523809%
hedgehog - 11.111111%
helicopter - 6.818182%
ibis - 2.500000%
inline_skate - 31.250000%
joshua_tree - 3.125000%
kangaroo - 9.302325%
ketch - 15.789474%
lamp - 3.225806%
laptop - 0.000000%
llama - 2.564103%
lobster - 4.761905%
lotus - 3.030303%
mandolin - 0.000000%
mayfly - 5.000000%
menorah - 6.818182%
metronome - 18.750000%
minaret - 52.631580%
nautilus - 7.142857%
octopus - 16.666666%
okapi - 15.000000%
pagoda - 45.833332%

panda - 0.000000%
pigeon - 0.000000%
pizza - 3.703704%
platypus - 5.882353%
pyramid - 3.448276%
revolver - 7.317073%
rhino - 3.333333%
rooster - 8.000000%
saxophone - 20.000000%
schooner - 6.250000%
scissors - 15.000000%
scorpion - 2.380952%
sea_horse - 0.000000%
snoopy - 16.666666%
soccer_ball - 12.500000%
stapler - 0.000000%
starfish - 13.953488%
stegosaurus - 10.000000%
stop_sign - 31.250000%
strawberry - 11.111111%
sunflower - 18.604650%
tick - 28.000000%
trilobite - 55.813953%
umbrella - 2.631579%
watch - 22.500000%
water_lilly - 5.263158%
wheelchair - 10.000000%
wild_cat - 0.000000%
windsor_chair - 7.142857%
wrench - 35.000000%
yin_yang - 30.000000%
Overall: 28.015648%

Quantization Level : 4

BACKGROUND_Google - 11.538462%
Faces - 35.779816%
Faces_easy - 49.082569%
Leopards - 92.000000%
Motorbikes - 80.451126%
accordion - 32.142857%
airplanes - 63.000000%
anchor - 14.285714%
ant - 14.285714%
barrel - 8.333333%
bass - 0.000000%
beaver - 4.347826%
binocular - 0.000000%
bonsai - 15.625000%

brain - 22.448980%
brontosaurus - 0.000000%
buddha - 4.651163%
butterfly - 8.695652%
camera - 8.000000%
cannon - 9.090909%
car_side - 72.580643%
ceiling_fan - 12.500000%
cellphone - 23.333334%
chair - 3.225806%
chandelier - 3.703704%
cougar_body - 12.500000%
cougar_face - 11.428572%
crab - 5.405406%
crayfish - 0.000000%
crocodile - 4.000000%
crocodile_head - 0.000000%
cup - 3.448276%
dalmatian - 8.823529%
dollar_bill - 23.076923%
dolphin - 18.181818%
dragonfly - 0.000000%
electric_guitar - 5.263158%
elephant - 3.125000%
emu - 3.703704%
euphonium - 31.250000%
ewer - 4.651163%
ferry - 5.882353%
flamingo - 11.764706%
flamingo_head - 0.000000%
garfield - 35.294117%
gerenuk - 5.882353%
gramophone - 3.846154%
grand_piano - 18.000000%
hawksbill - 26.000000%
headphone - 9.523809%
hedgehog - 14.814815%
helicopter - 6.818182%
ibis - 2.500000%
inline_skate - 37.500000%
joshua_tree - 3.125000%
kangaroo - 6.976744%
ketch - 15.789474%
lamp - 3.225806%
laptop - 0.000000%
llama - 2.564103%
lobster - 4.761905%
lotus - 3.030303%
mandolin - 0.000000%

mayfly - 5.000000%
menorah - 9.090909%
metronome - 18.750000%
minaret - 47.368420%
nautilus - 7.142857%
octopus - 16.666666%
okapi - 15.000000%
pagoda - 37.500000%
panda - 0.000000%
pigeon - 0.000000%
pizza - 11.111111%
platypus - 5.882353%
pyramid - 3.448276%
revolver - 7.317073%
rhino - 3.333333%
rooster - 8.000000%
saxophone - 20.000000%
schooner - 6.250000%
scissors - 10.000000%
scorpion - 2.380952%
sea_horse - 0.000000%
snoopy - 16.666666%
soccer_ball - 12.500000%
stapler - 0.000000%
starfish - 9.302325%
stegosaurus - 10.000000%
stop_sign - 31.250000%
strawberry - 16.666666%
sunflower - 20.930233%
tick - 24.000000%
trilobite - 51.162792%
umbrella - 5.263158%
watch - 22.500000%
water_lilly - 5.263158%
wheelchair - 0.000000%
wild_cat - 0.000000%
windsor_chair - 14.285714%
wrench - 30.000000%
yin_yang - 26.666666%
Overall: 27.602695%

Quantization Level : 8

BACKGROUND_Google - 9.401710%
Faces - 35.321102%
Faces_easy - 49.541283%
Leopards - 90.000000%
Motorbikes - 75.438599%
accordion - 32.142857%

airplanes - 61.250000%
anchor - 14.285714%
ant - 14.285714%
barrel - 4.166667%
bass - 0.000000%
beaver - 4.347826%
binocular - 0.000000%
bonsai - 15.625000%
brain - 22.448980%
brontosaurus - 0.000000%
buddha - 4.651163%
butterfly - 8.695652%
camera - 8.000000%
cannon - 9.090909%
car_side - 72.580643%
ceiling_fan - 8.333333%
cellphone - 16.666666%
chair - 3.225806%
chandelier - 1.851852%
cougar_body - 12.500000%
cougar_face - 11.428572%
crab - 5.405406%
crayfish - 0.000000%
crocodile - 4.000000%
crocodile_head - 0.000000%
cup - 3.448276%
dalmatian - 8.823529%
dollar_bill - 23.076923%
dolphin - 18.181818%
dragonfly - 2.941176%
electric_guitar - 2.631579%
elephant - 3.125000%
emu - 3.703704%
euphonium - 28.125000%
ewer - 4.651163%
ferry - 5.882353%
flamingo - 11.764706%
flamingo_head - 0.000000%
garfield - 35.294117%
gerenuk - 5.882353%
gramophone - 3.846154%
grand_piano - 16.000000%
hawksbill - 22.000000%
headphone - 9.523809%
hedgehog - 7.407407%
helicopter - 6.818182%
ibis - 2.500000%
inline_skate - 31.250000%
joshua_tree - 3.125000%

kangaroo - 6.976744%
ketch - 15.789474%
lamp - 3.225806%
laptop - 0.000000%
llama - 2.564103%
lobster - 4.761905%
lotus - 3.030303%
mandolin - 0.000000%
mayfly - 5.000000%
menorah - 9.090909%
metronome - 18.750000%
minaret - 47.368420%
nautilus - 7.142857%
octopus - 16.666666%
okapi - 15.000000%
pagoda - 41.666668%
panda - 0.000000%
pigeon - 0.000000%
pizza - 7.407407%
platypus - 5.882353%
pyramid - 3.448276%
revolver - 7.317073%
rhino - 3.333333%
rooster - 8.000000%
saxophone - 20.000000%
schooner - 6.250000%
scissors - 10.000000%
scorpion - 0.000000%
sea_horse - 0.000000%
snoopy - 16.666666%
soccer_ball - 9.375000%
stapler - 0.000000%
starfish - 9.302325%
stegosaurus - 10.000000%
stop_sign - 31.250000%
strawberry - 16.666666%
sunflower - 18.604650%
tick - 20.000000%
trilobite - 44.186047%
umbrella - 5.263158%
watch - 19.166666%
water_lilly - 5.263158%
wheelchair - 0.000000%
wild_cat - 0.000000%
windsor_chair - 17.857143%
wrench - 20.000000%
yin_yang - 23.333334%
Overall: 26.320366%

Quantization Level : 16

BACKGROUND_Google - 8.547009%
Faces - 36.697247%
Faces_easy - 48.165138%
Leopards - 90.000000%
Motorbikes - 71.929825%
accordion - 21.428572%
airplanes - 62.500000%
anchor - 14.285714%
ant - 14.285714%
barrel - 4.166667%
bass - 3.703704%
beaver - 4.347826%
binocular - 0.000000%
bonsai - 14.062500%
brain - 22.448980%
brontosaurus - 0.000000%
buddha - 4.651163%
butterfly - 8.695652%
camera - 8.000000%
cannon - 9.090909%
car_side - 70.967743%
ceiling_fan - 12.500000%
cellphone - 6.666667%
chair - 3.225806%
chandelier - 3.703704%
cougar_body - 8.333333%
cougar_face - 8.571428%
crab - 8.108109%
crayfish - 0.000000%
crocodile - 4.000000%
crocodile_head - 0.000000%
cup - 3.448276%
dalmatian - 5.882353%
dollar_bill - 19.230770%
dolphin - 12.121212%
dragonfly - 2.941176%
electric_guitar - 2.631579%
elephant - 6.250000%
emu - 3.703704%
euphonium - 25.000000%
ewer - 6.976744%
ferry - 5.882353%
flamingo - 8.823529%
flamingo_head - 0.000000%
garfield - 35.294117%
gerenuk - 5.882353%

gramophone - 3.846154%
grand_piano - 10.000000%
hawksbill - 22.000000%
headphone - 9.523809%
hedgehog - 7.407407%
helicopter - 4.545455%
ibis - 2.500000%
inline_skate - 25.000000%
joshua_tree - 9.375000%
kangaroo - 6.976744%
ketch - 15.789474%
lamp - 3.225806%
laptop - 0.000000%
llama - 2.564103%
lobster - 4.761905%
lotus - 3.030303%
mandolin - 0.000000%
mayfly - 5.000000%
menorah - 6.818182%
metronome - 18.750000%
minaret - 50.000000%
nautilus - 3.571429%
octopus - 16.666666%
okapi - 15.000000%
pagoda - 20.833334%
panda - 0.000000%
pigeon - 0.000000%
pizza - 11.111111%
platypus - 5.882353%
pyramid - 3.448276%
revolver - 7.317073%
rhino - 3.333333%
rooster - 4.000000%
saxophone - 15.000000%
schooner - 6.250000%
scissors - 15.000000%
scorpion - 0.000000%
sea_horse - 0.000000%
snoopy - 11.111111%
soccer_ball - 9.375000%
stapler - 4.347826%
starfish - 6.976744%
stegosaurus - 10.000000%
stop_sign - 28.125000%
strawberry - 16.666666%
sunflower - 18.604650%
tick - 16.000000%
trilobite - 39.534885%
umbrella - 5.263158%

watch - 20.833334%
water_lilly - 10.526316%
wheelchair - 3.333333%
wild_cat - 0.000000%
windsor_chair - 7.142857%
wrench - 20.000000%
yin_yang - 23.333334%
Overall: 25.581396%

Quantization Level : 32

BACKGROUND_Google - 10.256411%
Faces - 31.192661%
Faces_easy - 49.541283%
Leopards - 90.000000%
Motorbikes - 64.411026%
accordion - 7.142857%
airplanes - 61.500000%
anchor - 9.523809%
ant - 4.761905%
barrel - 4.166667%
bass - 3.703704%
beaver - 4.347826%
binocular - 0.000000%
bonsai - 12.500000%
brain - 24.489796%
brontosaurus - 0.000000%
buddha - 6.976744%
butterfly - 2.173913%
camera - 8.000000%
cannon - 4.545455%
car_side - 69.354836%
ceiling_fan - 8.333333%
cellphone - 6.666667%
chair - 3.225806%
chandelier - 0.000000%
cougar_body - 8.333333%
cougar_face - 8.571428%
crab - 2.702703%
crayfish - 0.000000%
crocodile - 4.000000%
crocodile_head - 3.846154%
cup - 3.448276%
dalmatian - 2.941176%
dollar_bill - 19.230770%
dolphin - 6.060606%
dragonfly - 0.000000%
electric_guitar - 2.631579%
elephant - 0.000000%

emu - 0.000000%
euphonium - 18.750000%
ewer - 4.651163%
ferry - 11.764706%
flamingo - 11.764706%
flamingo_head - 0.000000%
garfield - 29.411764%
gerenuk - 5.882353%
gramophone - 3.846154%
grand_piano - 18.000000%
hawksbill - 22.000000%
headphone - 4.761905%
hedgehog - 3.703704%
helicopter - 4.545455%
ibis - 2.500000%
inline_skate - 25.000000%
joshua_tree - 6.250000%
kangaroo - 9.302325%
ketch - 14.035088%
lamp - 0.000000%
laptop - 2.439024%
llama - 5.128205%
lobster - 0.000000%
lotus - 3.030303%
mandolin - 4.545455%
mayfly - 10.000000%
menorah - 6.818182%
metronome - 18.750000%
minaret - 36.842106%
nautilus - 3.571429%
octopus - 16.666666%
okapi - 15.000000%
pagoda - 16.666666%
panda - 0.000000%
pigeon - 0.000000%
pizza - 11.111111%
platypus - 5.882353%
pyramid - 3.448276%
revolver - 9.756098%
rhino - 3.333333%
rooster - 4.000000%
saxophone - 10.000000%
schooner - 9.375000%
scissors - 15.000000%
scorpion - 0.000000%
sea_horse - 0.000000%
snoopy - 16.666666%
soccer_ball - 9.375000%
stapler - 4.347826%

starfish - 9.302325%
stegosaurus - 10.000000%
stop_sign - 37.500000%
strawberry - 22.222221%
sunflower - 23.255814%
tick - 20.000000%
trilobite - 20.930233%
umbrella - 2.631579%
watch - 20.833334%
water_lilly - 5.263158%
wheelchair - 0.000000%
wild_cat - 11.764706%
windsor_chair - 10.714286%
wrench - 20.000000%
yin_yang - 33.333332%
Overall: 24.277330%

-- 2x2 Cell Histograms

Quantization Level : 1

BACKGROUND_Google - 15.384615%
Faces - 38.532108%
Faces_easy - 55.963303%
Leopards - 84.000000%
Motorbikes - 86.215538%
accordion - 17.857143%
airplanes - 62.750000%
anchor - 4.761905%
ant - 0.000000%
barrel - 0.000000%
bass - 3.703704%
beaver - 8.695652%
binocular - 5.882353%
bonsai - 15.625000%
brain - 34.693878%
brontosaurus - 0.000000%
buddha - 9.302325%
butterfly - 4.347826%
camera - 16.000000%
cannon - 9.090909%
car_side - 46.774193%
ceiling_fan - 8.333333%
cellphone - 30.000000%
chair - 3.225806%

chandelier - 3.703704%
cougar_body - 12.500000%
cougar_face - 8.571428%
crab - 8.108109%
crayfish - 5.714286%
crocodile - 4.000000%
crocodile_head - 0.000000%
cup - 6.896552%
dalmatian - 5.882353%
dollar_bill - 26.923077%
dolphin - 6.060606%
dragonfly - 0.000000%
electric_guitar - 10.526316%
elephant - 9.375000%
emu - 3.703704%
euphonium - 21.875000%
ewer - 6.976744%
ferry - 11.764706%
flamingo - 8.823529%
flamingo_head - 0.000000%
garfield - 41.176472%
gerenuk - 0.000000%
gramophone - 0.000000%
grand_piano - 32.000000%
hawksbill - 14.000000%
headphone - 14.285714%
hedgehog - 3.703704%
helicopter - 6.818182%
ibis - 0.000000%
inline_skate - 43.750000%
joshua_tree - 18.750000%
kangaroo - 2.325581%
ketch - 35.087719%
lamp - 3.225806%
laptop - 2.439024%
llama - 2.564103%
lobster - 4.761905%
lotus - 3.030303%
mandolin - 4.545455%
mayfly - 10.000000%
menorah - 20.454546%
metronome - 31.250000%
minaret - 55.263157%
nautilus - 0.000000%
octopus - 16.666666%
okapi - 15.000000%
pagoda - 29.166666%
panda - 0.000000%
pigeon - 0.000000%

pizza - 14.814815%
platypus - 11.764706%
pyramid - 3.448276%
revolver - 4.878049%
rhino - 0.000000%
rooster - 8.000000%
saxophone - 15.000000%
schooner - 12.500000%
scissors - 20.000000%
scorpion - 14.285714%
sea_horse - 0.000000%
snoopy - 44.444443%
soccer_ball - 15.625000%
stapler - 4.347826%
starfish - 16.279070%
stegosaurus - 16.666666%
stop_sign - 40.625000%
strawberry - 11.111111%
sunflower - 30.232557%
tick - 20.000000%
trilobite - 53.488373%
umbrella - 10.526316%
watch - 39.166668%
water_lilly - 10.526316%
wheelchair - 16.666666%
wild_cat - 0.000000%
windsor_chair - 7.142857%
wrench - 25.000000%
yin_yang - 36.666668%
Overall: 29.906542%

Quantization Level : 4

BACKGROUND_Google - 9.829060%
Faces - 38.073395%
Faces_easy - 52.752293%
Leopards - 86.000000%
Motorbikes - 84.711777%
accordion - 10.714286%
airplanes - 62.000000%
anchor - 9.523809%
ant - 4.761905%
barrel - 4.166667%
bass - 7.407407%
beaver - 8.695652%
binocular - 5.882353%
bonsai - 3.125000%
brain - 40.816326%
brontosaurus - 0.000000%
buddha - 4.651163%

butterfly - 6.521739%
camera - 16.000000%
cannon - 4.545455%
car_side - 45.161289%
ceiling_fan - 4.166667%
cellphone - 20.000000%
chair - 6.451613%
chandelier - 11.111111%
cougar_body - 16.666666%
cougar_face - 8.571428%
crab - 5.405406%
crayfish - 2.857143%
crocodile - 8.000000%
crocodile_head - 0.000000%
cup - 6.896552%
dalmatian - 2.941176%
dollar_bill - 30.769230%
dolphin - 6.060606%
dragonfly - 5.882353%
electric_guitar - 13.157895%
elephant - 9.375000%
emu - 3.703704%
euphonium - 25.000000%
ewer - 6.976744%
ferry - 11.764706%
flamingo - 5.882353%
flamingo_head - 0.000000%
garfield - 35.294117%
gerenuk - 0.000000%
gramophone - 0.000000%
grand_piano - 22.000000%
hawksbill - 20.000000%
headphone - 19.047619%
hedgehog - 3.703704%
helicopter - 2.272727%
ibis - 0.000000%
inline_skate - 50.000000%
joshua_tree - 9.375000%
kangaroo - 6.976744%
ketch - 35.087719%
lamp - 3.225806%
laptop - 4.878049%
llama - 2.564103%
lobster - 0.000000%
lotus - 3.030303%
mandolin - 9.090909%
mayfly - 10.000000%
menorah - 20.454546%
metronome - 25.000000%

minaret - 36.842106%
nautilus - 0.000000%
octopus - 11.111111%
okapi - 15.000000%
pagoda - 41.666668%
panda - 5.263158%
pigeon - 4.347826%
pizza - 14.814815%
platypus - 5.882353%
pyramid - 0.000000%
revolver - 4.878049%
rhino - 6.666667%
rooster - 4.000000%
saxophone - 0.000000%
schooner - 6.250000%
scissors - 25.000000%
scorpion - 7.142857%
sea_horse - 3.448276%
snoopy - 22.222221%
soccer_ball - 15.625000%
stapler - 4.347826%
starfish - 11.627907%
stegosaurus - 16.666666%
stop_sign - 37.500000%
strawberry - 11.111111%
sunflower - 27.906977%
tick - 12.000000%
trilobite - 58.139534%
umbrella - 0.000000%
watch - 33.333332%
water_lilly - 5.263158%
wheelchair - 13.333333%
wild_cat - 0.000000%
windsor_chair - 10.714286%
wrench - 30.000000%
yin_yang - 40.000000%
Overall: 28.559010%

Quantization Level : 8

BACKGROUND_Google - 13.247863%
Faces - 45.412846%
Faces_easy - 44.954128%
Leopards - 77.000000%
Motorbikes - 84.711777%
accordion - 14.285714%
airplanes - 67.750000%
anchor - 9.523809%
ant - 4.761905%

barrel - 0.000000%
bass - 7.407407%
beaver - 8.695652%
binocular - 5.882353%
bonsai - 4.687500%
brain - 32.653061%
brontosaurus - 9.090909%
buddha - 4.651163%
butterfly - 6.521739%
camera - 16.000000%
cannon - 9.090909%
car_side - 56.451614%
ceiling_fan - 4.166667%
cellphone - 20.000000%
chair - 6.451613%
chandelier - 5.555555%
cougar_body - 16.666666%
cougar_face - 11.428572%
crab - 13.513514%
crayfish - 2.857143%
crocodile - 4.000000%
crocodile_head - 3.846154%
cup - 3.448276%
dalmatian - 8.823529%
dollar_bill - 50.000000%
dolphin - 9.090909%
dragonfly - 2.941176%
electric_guitar - 2.631579%
elephant - 3.125000%
emu - 7.407407%
euphonium - 28.125000%
ewer - 6.976744%
ferry - 17.647058%
flamingo - 11.764706%
flamingo_head - 0.000000%
garfield - 41.176472%
gerenuk - 0.000000%
gramophone - 0.000000%
grand_piano - 32.000000%
hawksbill - 22.000000%
headphone - 14.285714%
hedgehog - 0.000000%
helicopter - 4.545455%
ibis - 5.000000%
inline_skate - 43.750000%
joshua_tree - 18.750000%
kangaroo - 6.976744%
ketch - 31.578947%
lamp - 3.225806%

laptop - 4.878049%
llama - 2.564103%
lobster - 0.000000%
lotus - 3.030303%
mandolin - 13.636364%
mayfly - 5.000000%
menorah - 20.454546%
metronome - 18.750000%
minaret - 52.631580%
nautilus - 3.571429%
octopus - 11.111111%
okapi - 15.000000%
pagoda - 50.000000%
panda - 5.263158%
pigeon - 4.347826%
pizza - 11.111111%
platypus - 5.882353%
pyramid - 0.000000%
revolver - 17.073172%
rhino - 3.333333%
rooster - 4.000000%
saxophone - 10.000000%
schooner - 15.625000%
scissors - 20.000000%
scorpion - 9.523809%
sea_horse - 0.000000%
snoopy - 22.222221%
soccer_ball - 15.625000%
stapler - 8.695652%
starfish - 13.953488%
stegosaurus - 3.333333%
stop_sign - 31.250000%
strawberry - 11.111111%
sunflower - 11.627907%
tick - 20.000000%
trilobite - 51.162792%
umbrella - 5.263158%
watch - 36.666668%
water_lilly - 5.263158%
wheelchair - 0.000000%
wild_cat - 5.882353%
windsor_chair - 7.142857%
wrench - 25.000000%
yin_yang - 43.333332%
Overall: 29.602261%

Quantization Level : 16

BACKGROUND_Google - 12.393163%

Faces - 33.944954%
Faces_easy - 57.798164%
Leopards - 85.000000%
Motorbikes - 80.701752%
accordion - 25.000000%
airplanes - 67.750000%
anchor - 14.285714%
ant - 0.000000%
barrel - 0.000000%
bass - 3.703704%
beaver - 13.043478%
binocular - 5.882353%
bonsai - 6.250000%
brain - 24.489796%
brontosaurus - 4.545455%
buddha - 4.651163%
butterfly - 4.347826%
camera - 0.000000%
cannon - 4.545455%
car_side - 67.741936%
ceiling_fan - 0.000000%
cellphone - 13.333333%
chair - 6.451613%
chandelier - 12.962963%
cougar_body - 16.666666%
cougar_face - 5.714286%
crab - 10.810811%
crayfish - 2.857143%
crocodile - 4.000000%
crocodile_head - 0.000000%
cup - 6.896552%
dalmatian - 5.882353%
dollar_bill - 53.846153%
dolphin - 9.090909%
dragonfly - 2.941176%
electric_guitar - 5.263158%
elephant - 15.625000%
emu - 3.703704%
euphonium - 25.000000%
ewer - 2.325581%
ferry - 11.764706%
flamingo - 14.705882%
flamingo_head - 0.000000%
garfield - 41.176472%
gerenuk - 5.882353%
gramophone - 0.000000%
grand_piano - 30.000000%
hawksbill - 24.000000%
headphone - 4.761905%

hedgehog - 7.407407%
helicopter - 9.090909%
ibis - 5.000000%
inline_skate - 43.750000%
joshua_tree - 15.625000%
kangaroo - 6.976744%
ketch - 17.543859%
lamp - 3.225806%
laptop - 4.878049%
llama - 2.564103%
lobster - 0.000000%
lotus - 3.030303%
mandolin - 4.545455%
mayfly - 5.000000%
menorah - 15.909091%
metronome - 18.750000%
minaret - 63.157894%
nautilus - 3.571429%
octopus - 11.111111%
okapi - 10.000000%
pagoda - 45.833332%
panda - 0.000000%
pigeon - 8.695652%
pizza - 14.814815%
platypus - 0.000000%
pyramid - 3.448276%
revolver - 19.512196%
rhino - 3.333333%
rooster - 8.000000%
saxophone - 20.000000%
schooner - 6.250000%
scissors - 25.000000%
scorpion - 7.142857%
sea_horse - 3.448276%
snoopy - 22.222221%
soccer_ball - 12.500000%
stapler - 4.347826%
starfish - 16.279070%
stegosaurus - 6.666667%
stop_sign - 40.625000%
strawberry - 16.666666%
sunflower - 20.930233%
tick - 4.000000%
trilobite - 62.790699%
umbrella - 7.894737%
watch - 25.833334%
water_lilly - 5.263158%
wheelchair - 6.666667%
wild_cat - 11.764706%

windsor_chair - 7.142857%
wrench - 15.000000%
yin_yang - 40.000000%
Overall: 29.232775%

Quantization Level : 32

BACKGROUND_Google - 10.683761%
Faces - 32.568806%
Faces_easy - 56.422020%
Leopards - 79.000000%
Motorbikes - 78.446114%
accordion - 7.142857%
airplanes - 63.750000%
anchor - 9.523809%
ant - 0.000000%
barrel - 0.000000%
bass - 0.000000%
beaver - 8.695652%
binocular - 0.000000%
bonsai - 9.375000%
brain - 20.408163%
brontosaurus - 4.545455%
buddha - 2.325581%
butterfly - 2.173913%
camera - 8.000000%
cannon - 0.000000%
car_side - 67.741936%
ceiling_fan - 0.000000%
cellphone - 20.000000%
chair - 6.451613%
chandelier - 9.259259%
cougar_body - 16.666666%
cougar_face - 8.571428%
crab - 2.702703%
crayfish - 5.714286%
crocodile - 8.000000%
crocodile_head - 3.846154%
cup - 3.448276%
dalmatian - 0.000000%
dollar_bill - 42.307693%
dolphin - 12.121212%
dragonfly - 0.000000%
electric_guitar - 2.631579%
elephant - 15.625000%
emu - 7.407407%
euphonium - 28.125000%
ewer - 2.325581%

ferry - 8.823529%
flamingo - 14.705882%
flamingo_head - 0.000000%
garfield - 29.411764%
gerenuk - 5.882353%
gramophone - 0.000000%
grand_piano - 30.000000%
hawksbill - 24.000000%
headphone - 9.523809%
hedgehog - 7.407407%
helicopter - 6.818182%
ibis - 10.000000%
inline_skate - 50.000000%
joshua_tree - 18.750000%
kangaroo - 6.976744%
ketch - 21.052631%
lamp - 3.225806%
laptop - 2.439024%
llama - 2.564103%
lobster - 0.000000%
lotus - 3.030303%
mandolin - 4.545455%
mayfly - 10.000000%
menorah - 15.909091%
metronome - 18.750000%
minaret - 44.736843%
nautilus - 3.571429%
octopus - 11.111111%
okapi - 10.000000%
pagoda - 41.666668%
panda - 0.000000%
pigeon - 0.000000%
pizza - 11.111111%
platypus - 5.882353%
pyramid - 3.448276%
revolver - 19.512196%
rhino - 3.333333%
rooster - 4.000000%
saxophone - 20.000000%
schooner - 12.500000%
scissors - 20.000000%
scorpion - 0.000000%
sea_horse - 6.896552%
snoopy - 11.111111%
soccer_ball - 12.500000%
stapler - 4.347826%
starfish - 13.953488%
stegosaurus - 10.000000%
stop_sign - 37.500000%

strawberry - 16.666666%
sunflower - 25.581396%
tick - 12.000000%
trilobite - 30.232557%
umbrella - 7.894737%
watch - 25.833334%
water_lilly - 5.263158%
wheelchair - 10.000000%
wild_cat - 11.764706%
windsor_chair - 7.142857%
wrench - 5.000000%
yin_yang - 43.333332%
Overall: 27.559227%