lasso

July 19, 2019

[1]:
```
using CSV, Images
using Convex, SCS
```

[2]:
```
function read_image(filename :: String)
    image = CSV.read(filename;header=false)
    Y = convert(Matrix, image)
    return Y
end
```

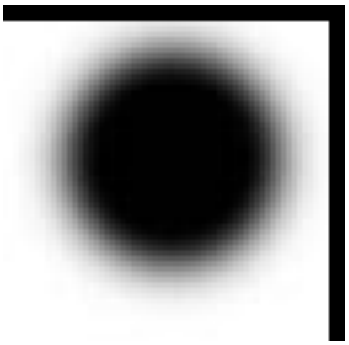
[2]:
```
read_image (generic function with 1 method)
```

[3]:
```
function lasso(Y :: Matrix, =1.0, p=1)

    solver = SCSSolver(verbose=false)
    n, m = size(Y)
     = Variable(n, m)

    obj = 0.5 * square(norm(vec(Y - )))
    for i in 1:n
        for j in 1:m
            (j < m) ? (vec0 = abs([i, j] - [i, j+1])) : (vec0 = 0)
            (i < n) ? (vec1 = abs([i, j] - [i+1, j])) : (vec1 = 0)
            obj = obj +  * norm(vcat(vec0, vec1), p)
        end
    end

    prob = minimize(obj)
    solve!(prob, solver)
    return prob.optval, .value
end
```

[3]:
```
lasso (generic function with 3 methods)
```

[4]:
```
toy = read_image("../toy.csv")
img = Gray.(toy)
```

[4]:

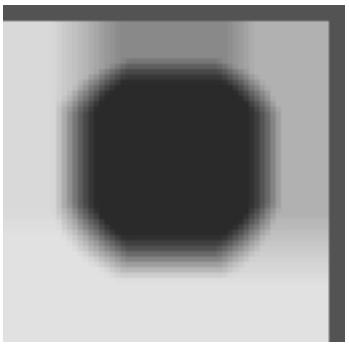


[5]:
```
opt1, img1 = lasso(toy, 1, 1)
println(opt1)
Gray.(img1)
```

```
 Warning: Problem status UnknownError; solution may be inaccurate.
 @ Convex /home/zzz/.julia/packages/Convex/81M4N/src/solution.jl:48
```

```
199.76506083723208
```

[5]:

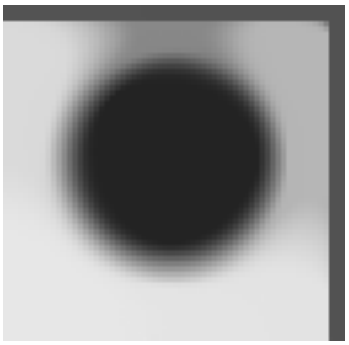


[6]:
```
opt2, img2 = lasso(toy, 1, 2)
println(opt2)
Gray.(img2)
```

```
182.195910735048
```

```
 Warning: Problem status UnknownError; solution may be inaccurate.
 @ Convex /home/zzz/.julia/packages/Convex/81M4N/src/solution.jl:48
```

[6]:



[7]:
```
baboon = read_image("../baboon.csv")
img = Gray.(baboon)
```

[7]:

[9]:
```
 = []
for p in 1:2
    for  in 0:8
        opt, img = lasso(baboon, 10^(-/4), p)
        push!(, (opt, img))
        println("For $p-norm lasso problem with =$(10^(-/4)), the optimal value␣
↪is $opt and the solution image is shown above.")
        display(Gray.(img))
    end
end
```

For 1-norm lasso problem with =1.0, the optimal value is 36.59956495865463 and the solution image is shown above.

For 1-norm lasso problem with =0.5623413251903491, the optimal value is 34.71682852515979 and the solution image is shown above.

For 1-norm lasso problem with =0.31622776601683794, the optimal value is 29.21712609198416 and the solution image is shown above.

For 1-norm lasso problem with =0.1778279410038923, the optimal value is 22.60146094248819 and the solution image is shown above.

For 1-norm lasso problem with =0.1, the optimal value is 16.651521984834577 and the solution image is shown above.

For 1-norm lasso problem with =0.05623413251903491, the optimal value is 11.91352183235471 and the solution image is shown above.

For 1-norm lasso problem with =0.03162277660168379, the optimal value is 8.19752325636375 and the solution image is shown above.

For 1-norm lasso problem with =0.01778279410038923, the optimal value is 5.424481105411913 and the solution image is shown above.

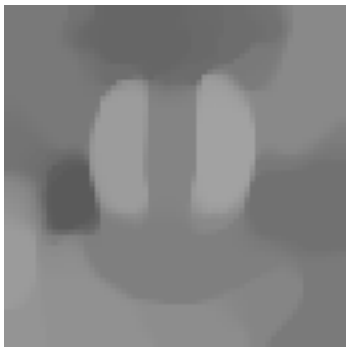
For 1-norm lasso problem with =0.01, the optimal value is 3.446810173293887 and the solution image is shown above.

For 2-norm lasso problem with =1.0, the optimal value is 36.42261488992827 and the solution image is shown above.

```
 Warning: Problem status UnknownError; solution may be inaccurate.
 @ Convex /home/zzz/.julia/packages/Convex/81M4N/src/solution.jl:48
```

For 2-norm lasso problem with =0.5623413251903491, the optimal value is 33.77584638066108 and the solution image is shown above.

```
 Warning: Problem status UnknownError; solution may be inaccurate.
 @ Convex /home/zzz/.julia/packages/Convex/81M4N/src/solution.jl:48
```



For 2-norm lasso problem with =0.31622776601683794, the optimal value is 27.72448963616958 and the solution image is shown above.

```
 Warning: Problem status UnknownError; solution may be inaccurate.
 @ Convex /home/zzz/.julia/packages/Convex/81M4N/src/solution.jl:48
```

For 2-norm lasso problem with =0.1778279410038923, the optimal value is 21.085202998806004 and the solution image is shown above.

```
 Warning: Problem status UnknownError; solution may be inaccurate.
 @ Convex /home/zzz/.julia/packages/Convex/81M4N/src/solution.jl:48
```

For 2-norm lasso problem with =0.1, the optimal value is 15.345543079785996 and the solution image is shown above.

For 2-norm lasso problem with =0.05623413251903491, the optimal value is 10.786650678300848 and the solution image is shown above.

For 2-norm lasso problem with =0.03162277660168379, the optimal value is 7.262279843486341 and the solution image is shown above.

For 2-norm lasso problem with =0.01778279410038923, the optimal value is 4.69310885180088 and the solution image is shown above.

```
For 2-norm lasso problem with =0.01, the optimal value is 2.9123384884199224
and the solution image is shown above.
```

[ ]: