Task 2: gradient domain manipulation

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Our solution description:

We noticed that although it uses a set of very logical assumptions, the Fattal algorithm gets fair results but not more. So we figured that it will make sense to improve the already good method, and make it better.

The main idea came from our observations of the algorithm's output images that looks a bit discolored in some areas as result of the compression. We figured that this might happen because sometimes shift in colors caused by the object texture, results high magnitude for the gradient in that border.
This made us think that it might be a good idea to compensate this phenomena.

What we actually did, was to take the HSV space of the image, and except taking the V channel as the luminance and manipulate it , we also passed the H – hue channel to the algorithm to extract this channel's gradient's magnitude too, in hope for this map to give us some independent information about the color changings in the image. what our solution dose is to make a correlating pyramid for this result, divide it by a new proportion constant and add it to the Fattal corresponding pyramid level result. The resulting attenuation map is then passed to the rest of the procedure. So we get for each pyramid level:

$$\frac{||\nabla C_k||}{p} + \left(\frac{||\nabla H_k||}{a}\right)^{\beta-1}$$

when the ∇H_k and a are as in fattals paper, and ∇C is the hue picture's gradient.

As can be seen, the higher the p is is getting this new attenuation closer to the original Fattal solution, so we can control this component easily.

this parameter we added is local changing and depends on the input image, this results an input based compensation instead of a global one.

Results:

Figure 1: Memorial half

(a) Fattal's (b) Our solution

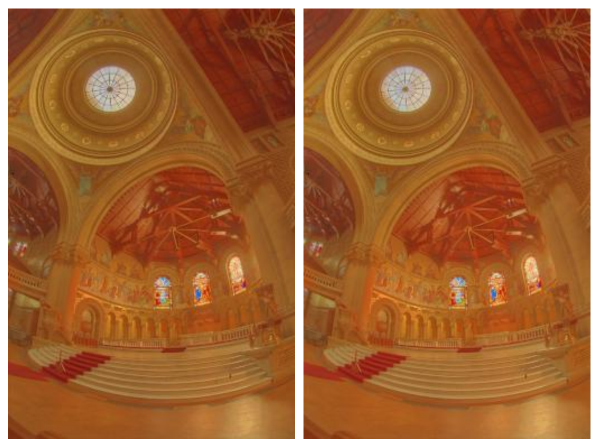
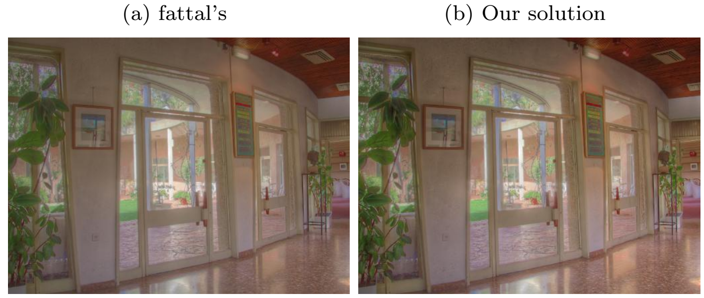


Figure 2: belg-half

(a) fattal's (b) Our solution



As can be seen in the resulting images, our results are a bit better in the picture that has a higher range of colors as in the memorial-half or even the belg-half, we get richer coloring and still get quit good contrast. thus apperanty due to the compensation we add and fine tuning its proportions for the specific picture. In the case of lower range of colors such as the door image, our result seems to be less effective and in fact the fattal is looking a bit better.

Arguments Results:

Table 1: Fattal's Results:

	Alpha	Beta	Gamma
belg	1.09	8.68	1.6
booth	1.14	9.00	1.8
door	0.29	0.91	1.3
memorial	0.02	0.87	1.5

Table 2: Our Results:

	Alpha	Beta	Gamma	P
belg	0.08	8.58	1.4	20
booth	0.05	0.93	1.8	18
door	0.54	0.90	1.3	60
memorial	0.01	0.88	1.5	12

all of the output images are attached to this report.

Analysis:

The Fattal and our method should be limited in cases that the most of the details are in a rapid and intence change in the light reflectance in the image, such as black/white patterns. Our method is suppose to make this limitation smaller and less notable and manages to do so in a variaty of samples. On the extreme though, our method is far from perfect. For example, if the ratio factor is too small, we found that some hue artifacts are added around rich colored zones. In addition, we figured that images with less hue details should be set with very high P ratio ,e.g put more wight on the Fattal solution.this is maybe due to hue 'outliers' that take grater place in such cases. Taking to account that the Fattal solution is using a set of quit few parameters it's seems reasonable to us that adding one more parameter to minimize, in some cases, it's main fault might be very good improvement. On the other hand though, more time to experiment some different approach or making our's better really can't do bad.

Conclusion:

we managed to get quite good results on variety of HDR as well as LDR images. our corrections seems less robust from the original solution, but yet of course it is always possible to get very close to Fattal's outputs simply by raising the P parameter.

Figure 3: Memorial half

(a) Fattal's (b) Our solution