(9) Practice Problems

(1) Write a MATLAB code to solve the following image deblurring problem via FISTA .

$$\min_x \|Ax - b\|^2 + \lambda \|x\|_1$$

```
dim = 256; % using 256x256 photo
n = dim^2;
m = n;
RGB = double(imread('cameraman.jpg')); % read image and change to double
original = (RGB(:,:,1))/255; % scaling
fun = @(u) imgaussfilt(u,1); % filter
A = func2mat(fun, original); % change the filter operator to matrix
b = A * original(:); % blurred image
x = b; % set starting point as the blurred photo
y = x;
t = 1;
lam = 1e-4; % regularization parameter
```

Algorithm 1 FISTA

Initialization: pick $x_0 \in \mathbb{R}^n$ arbitrarily, $t_0 = 1$, $y_0 = x_0$

for $k = 0, 1, 2, \ldots$ **do**

$$x_{k+1} = prox_{h,\alpha}\left(y_k - \alpha \nabla g(y_k)\right)$$

$$t_{k+1} = \frac{1 + \sqrt{1 + 4t_k^2}}{2}$$

$$y_{k+1} = x_{k+1} + \left(\frac{t_k - 1}{t_{k+1}}\right)(x_{k+1} - x_k)$$

end for