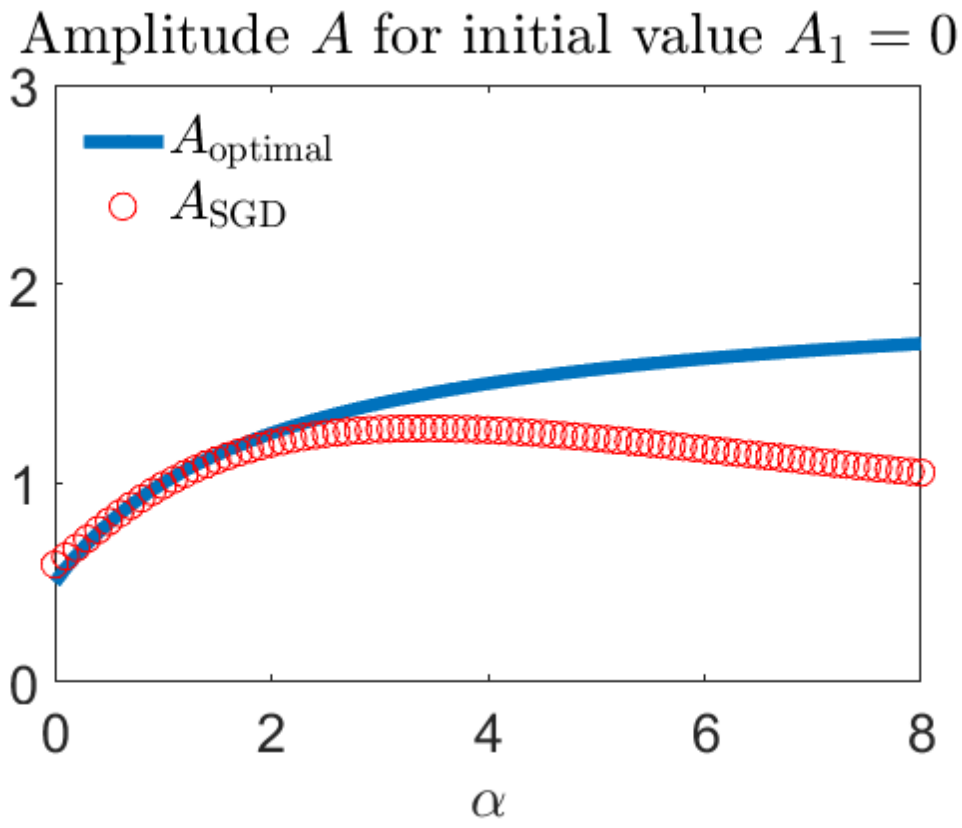
Contents

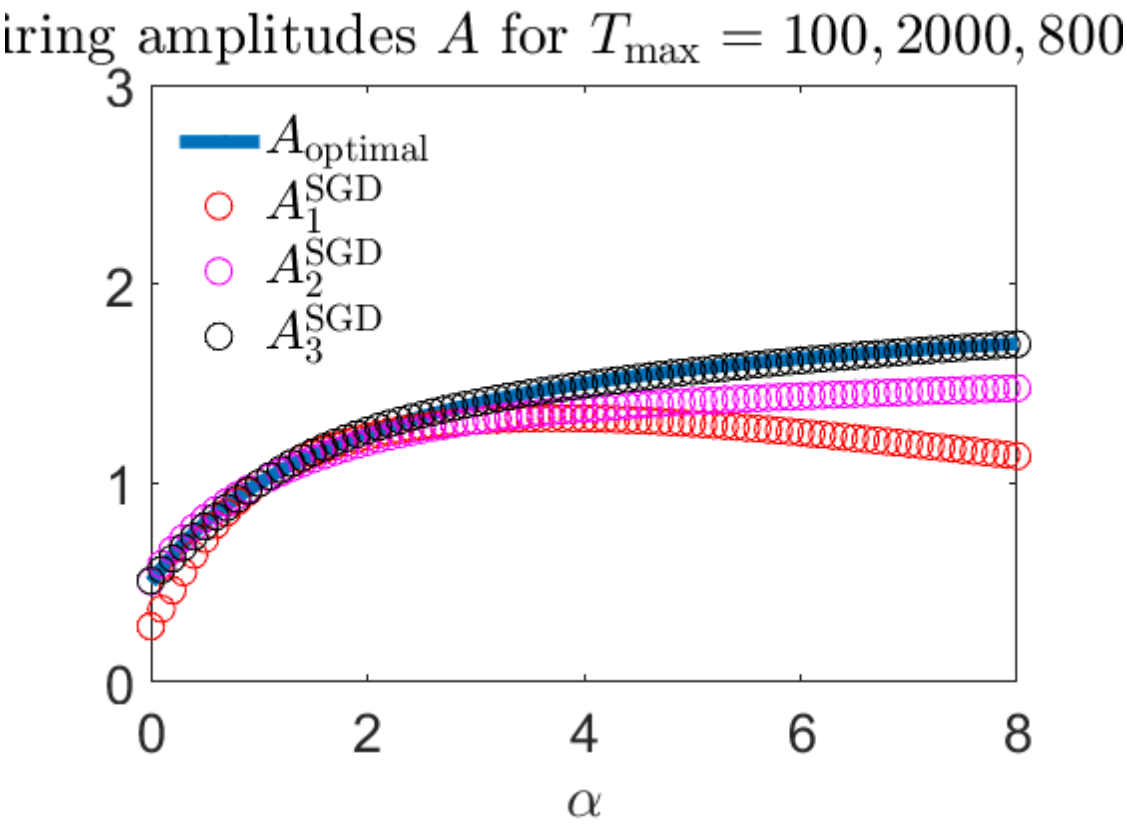
HW3 omni script.

```
% This is overarching container script for HW3 for BIO 347 / NEU 547 (2020 Fall)
% Run PUBLISH on this script to generate the html file for your submission
% for this homework assignment. Please save the generated html file as a
% pdf and submit that pdf on Blackboard.
%
% Make sure to save this script in the same folder as the other files:
%   * hw3q1template.m
%   * init_city.m
%   * SAILnet.m
%   * activities.m
%   * showrfs.m
%   * imagereconstruction.m
%   * IMAGES_CITY.mat
%   * SBUimage.mat
%
% The following files will be required for the bonus problem:
%   * filterimages.m
%   * init_myimages.m
```

Q1.a-b

```
hw3q1template % This will run the script hw3q1template, which you must complete.
```





Q1c: Write your answers as comments here:

```
% i) As Tmax is increased, the SGD predictions agree better with the
% theoretical prediction. This is because increasing Tmax is increasing the
% number of iterations. For each iteration, a new stimulus is presented to
```

```
% the neuron and the value of A is adjusted another time to be closer to
% the optimal value shown in Atheory. The more stimuli that are presented
% to the neuron, the better the neuron can determine the optimal value of
% amplitude A.

% ii) For each run, a different set of stimulus values is presented to the
% neuron across all the iterations. A different set of stimulus values is
% being used to predict the optimal values of A for the neurons. This
% causes the predicted values of A to be slightly different for each run.
```

Palate cleansing (clean up before running next set of scripts)

```
clear % clear workspace
close all % close figures
```

Q2a. Write your answers as comments here:

```
% i) The receptive fields of the neuron trained on natural images have
% large variation in their features, and therefore in the visual stimuli
% they would respond to. These receptive fields include many different
% angles for edge detection, edges of varying widths, and different
% levels of contrast. The receptive fields of the neuron trained on grating
% images only include four different angles, all edges have the same
% widths, and only include a high level of contrast.

% ii) The network trained on gratings is much worse at encoding the image
% of SBU because its receptive field features only 0, 45, and 90 degree
% edges. These neurons only respond to edges of these angles, which are
% relatively uncommon in a real photograph. They will not respond to any of
% the natural aspects of the photo - trees, grass, bushes - since these
% have edges of random angles. They will respond to some man-made structures
% in the photo, as these are more likely to have perfect 0, 45, or 90 degree
% angle edges. Some examples include horizontal roofs, vertical poles and
% walls, and tile patterns that may include horizontal, vertical, or
% diagonal lines. The network trained on natural images, on the other hand,
% responds to edges of many different angles. It is therefore able to
% better encode the image of SBU.

% iii) An animal raised in a visual envrionment consisting of only these
% grating images would be unable to visualize most features of a natural
% landscape. The animal's brain would only be able to respond to edges with
% a few angles, which are less likely to appear in nature.
```

Q2b. Write your answers as comments here:

```
% The receptive fields of the neuroons will include edges with a wide
% variety of angles and variety of widths. Since the images of the city
% include trees and man-made structures, the receptive fields will respond
% to both softer (natural) and harsher (man-made) edges. Compared to the
% neurons trained on natural images, these neurons will respond better to
% buildings and man-made structures with more rigid angles. Compared to the
% neurons trained on grating images, these neurons will respond better to
% trees and humans with more random angles. Since these receptive fields
```

```
% essentially combine the response capabilities of the other two types of
% receptive fields, they will encode the image the best.
```

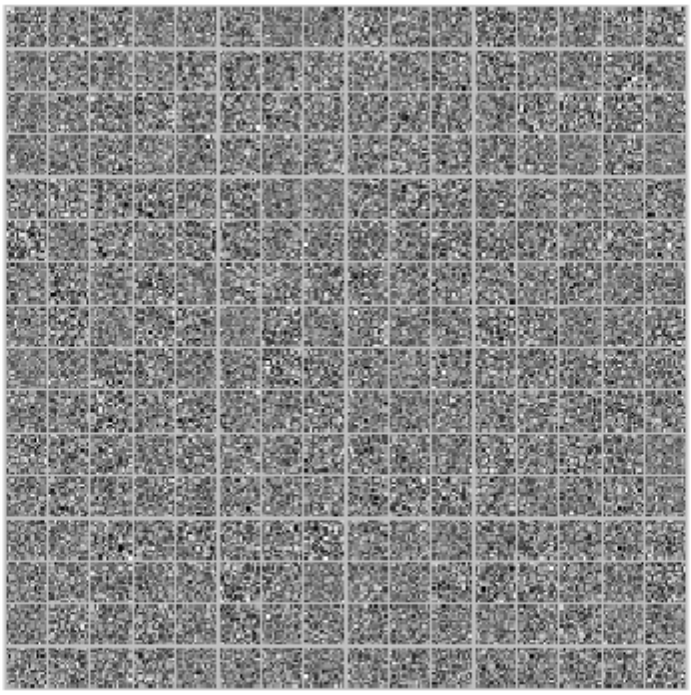
SAILnet on city images

```
% Initialize
init_city
```

```
Here we go _/)
```

Plot initial random receptive fields

```
figure;
showrfs(Q)
```

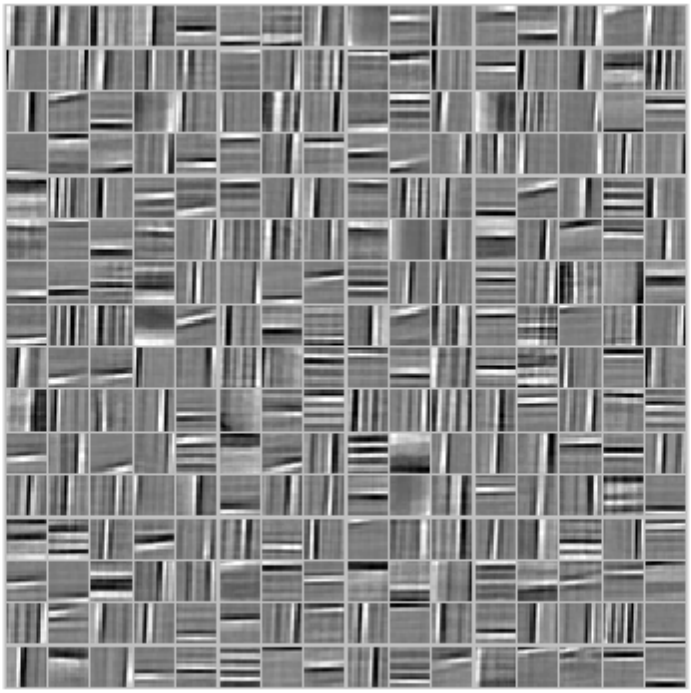


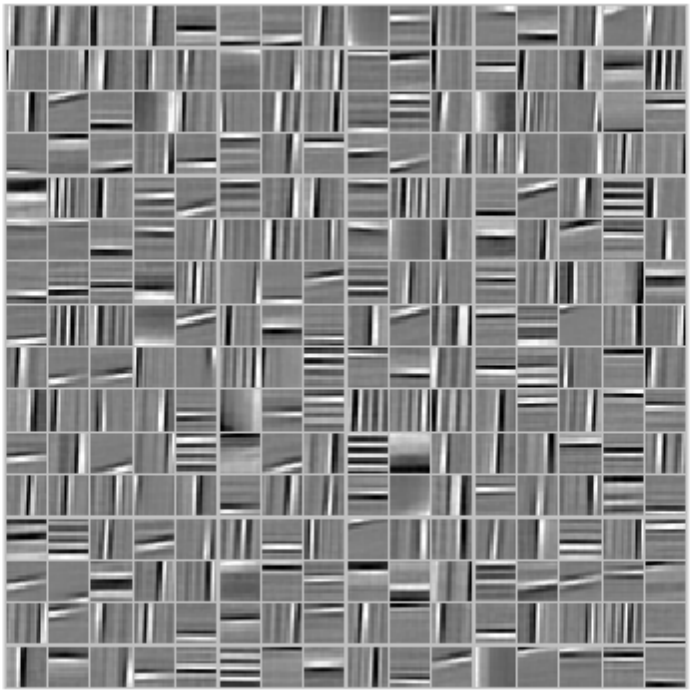
Run SAILnet

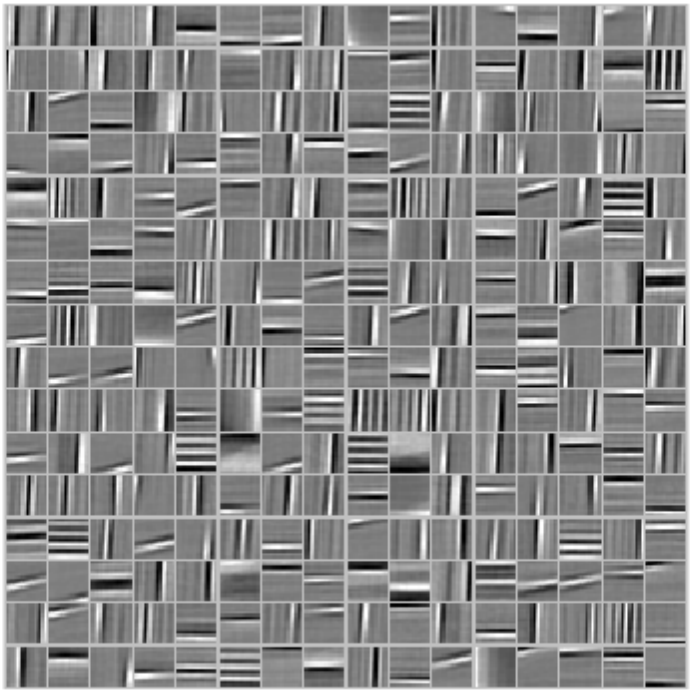
```
SAILnet
```

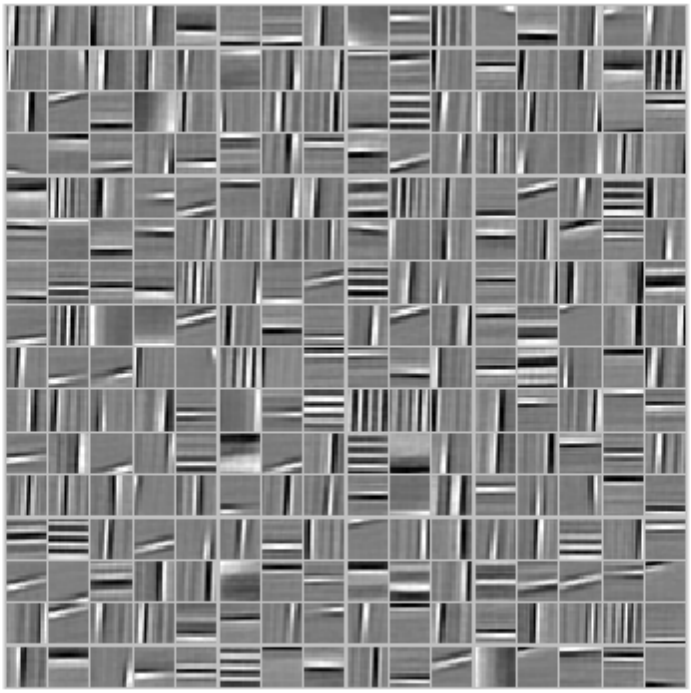
```
t =

        1000


t =
```

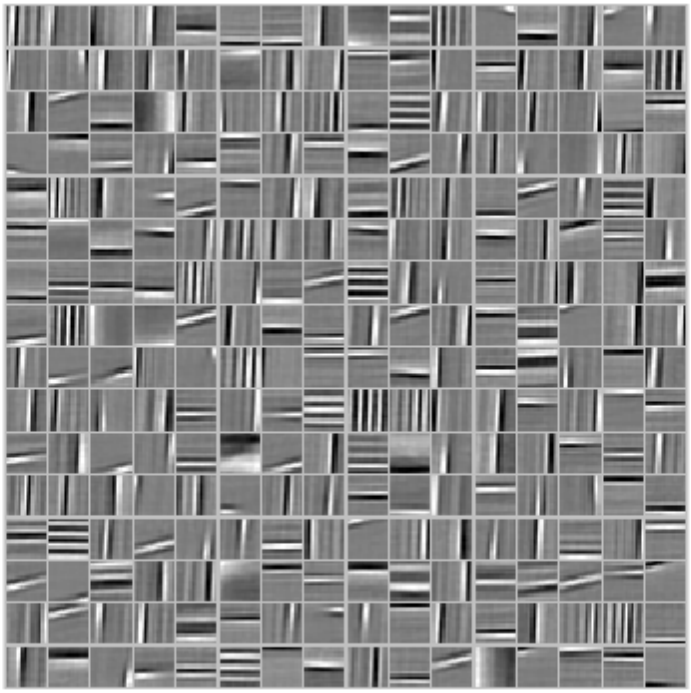
```
        2000

t =

        3000

t =

        4000

t =

        5000
```





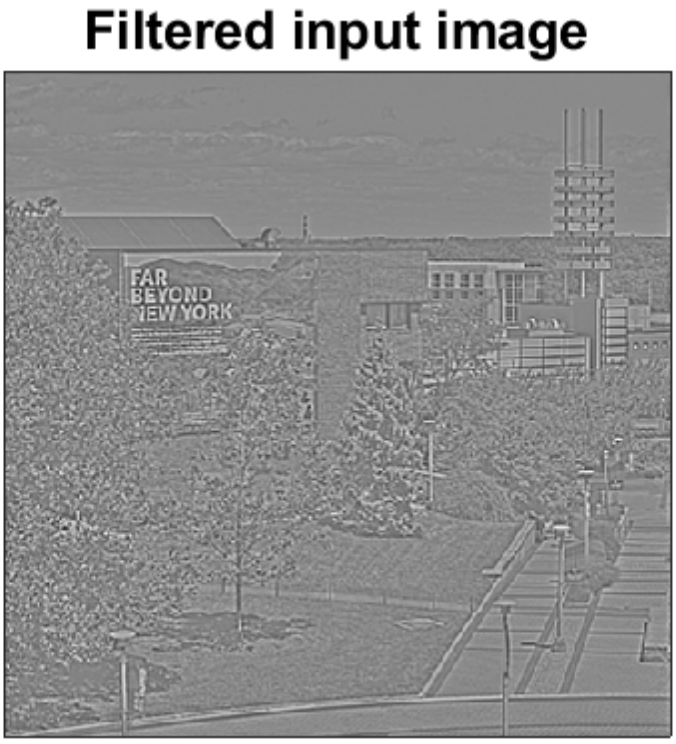


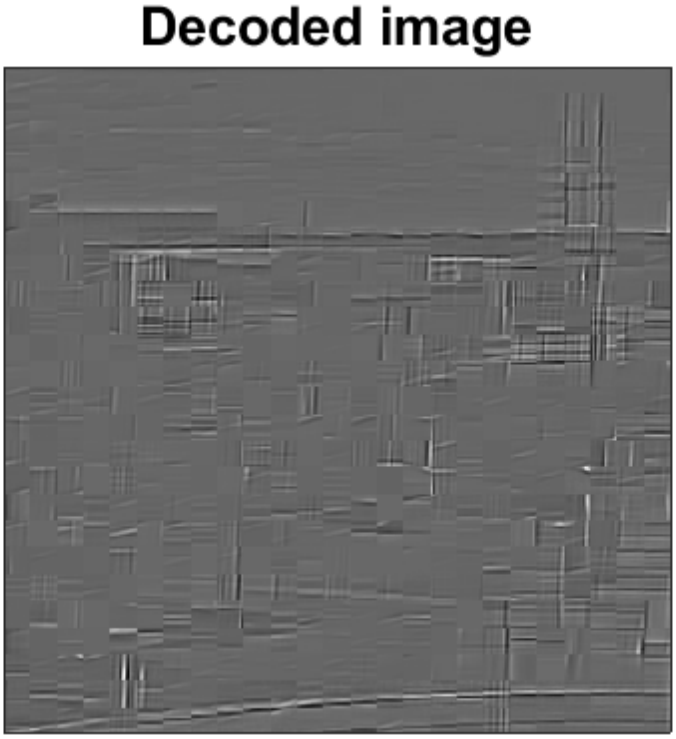




Use the receptive fields to decode the SBU image from model neuron activity!

```
imagereconstruction
```






```
close all % close figures
```

BONUS

```
% Uncomment the following lines only if you are doing the bonus problem.
```

SAILnet on city images

```
% Before running this section, find 10 images of a few hundred pixels on
% each side. Save these images to this same folder and then modify and run
% the script filterimages.m. Once you have run the filterimages function
% you can run this section of the script. Note that the images you select
% will be displayed here, so do not select something inappropriate for
% class/work!

% Initialize
init_myimages

% Display the images the network is being "trained" on

figure;
ax = axes;
imagesc(ax,IMAGES(:,:,1))
ax.XTick = [];
ax.YTick = [];
axis square
colormap('gray')

figure;
ax = axes;
imagesc(ax,IMAGES(:,:,2))
ax.XTick = [];
ax.YTick = [];
axis square
colormap('gray')

figure;
ax = axes;
imagesc(ax,IMAGES(:,:,3))
ax.XTick = [];
ax.YTick = [];
axis square
colormap('gray')

figure;
ax = axes;
imagesc(ax,IMAGES(:,:,4))
ax.XTick = [];
ax.YTick = [];
axis square
colormap('gray')

figure;
ax = axes;
imagesc(ax,IMAGES(:,:,5))
ax.XTick = [];
ax.YTick = [];
axis square
colormap('gray')
```

```
figure;
ax = axes;
imagesc(ax,IMAGES(:,:,6))
ax.XTick = [];
ax.YTick = [];
axis square
colormap('gray')

figure;
ax = axes;
imagesc(ax,IMAGES(:,:,7))
ax.XTick = [];
ax.YTick = [];
axis square
colormap('gray')

figure;
ax = axes;
imagesc(ax,IMAGES(:,:,8))
ax.XTick = [];
ax.YTick = [];
axis square
colormap('gray')

figure;
ax = axes;
imagesc(ax,IMAGES(:,:,9))
ax.XTick = [];
ax.YTick = [];
axis square
colormap('gray')

figure;
ax = axes;
imagesc(ax,IMAGES(:,:,10))
ax.XTick = [];
ax.YTick = [];
axis square
colormap('gray')
```

```
Here we go _/)
```

```
Error using load
Unable to find file or directory 'IMAGES_BONUS'.

Error in init_myimages (line 22)
load IMAGES_BONUS

Error in hw3omni (line 120)
init_myimages
```

Plot initial random receptive fields

```
figure;
showrfs(Q)
```

Run SAILnet

```
SAILnet
```

Use the receptive fields to decode a novel image!

```
imagereconstruction
```

```
close all % close figures
```

BONUS b: Write your answers as comments here.

```
%
```

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