

6.869 Pset #4  
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Collaborators: CK Ong

# 1A - Image 1

lemon (952), score 0.642  
orange (951), score 0.176  
Granny Smith (949), score 0.067



## 1A - Image 2

ambulance (408), score 0.833  
police van, police wagon, paddy wagon, patrol wagon, wagon, black Maria (735), score 0.049  
fire engine, fire truck (556), score 0.041



## 1A - Image 3

**Doberman, Doberman pinscher (237), score 0.998**  
**miniature pinscher (238), score 0.001**  
**black-and-tan coonhound (166), score 0.001**





# 1A - Image 4

warplane, military plane (896), score 0.513  
space shuttle (813), score 0.051  
water buffalo, water ox, Asiatic buffalo, Bubalus bubalis (347), score 0.048



# 1A - Image 5

stage (820), score 0.913  
electric guitar (547), score 0.026  
microphone, mike (651), score 0.015



1C - a

MathConvnet Model:

430500

=

$$\begin{aligned} &20*5*5*1 + \\ &50*5*5*20 + \\ &500*4*4*50 + \\ &10*1*1*500 \end{aligned}$$

Shallow Model:

253050

=

$$\begin{aligned} &50*9*9*1 + \\ &100*7*7*50 + \\ &(\text{conv layer}) 10*2*2*100 \end{aligned}$$

Deeper Model:

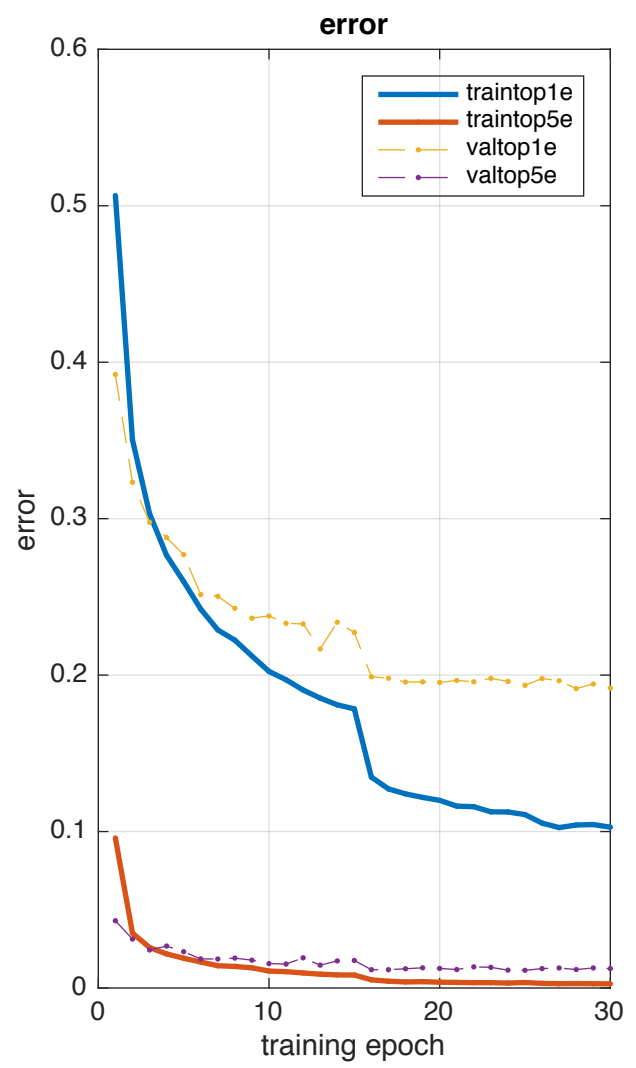
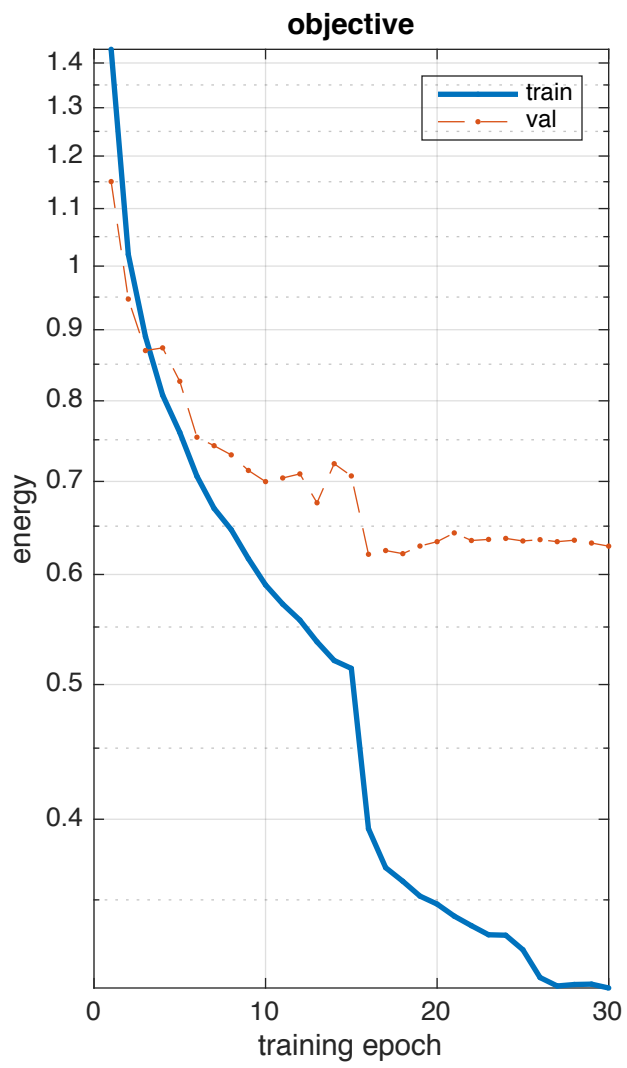
380170

=

$$\begin{aligned} &30*3*3*1 + \\ &20*3*3*30 + \\ &50*3*3*30 + \\ &50*3*3*30 + \\ &50*3*3*50 + \\ &500*4*4*40 + \\ &10*1*1*500 \end{aligned}$$

1B

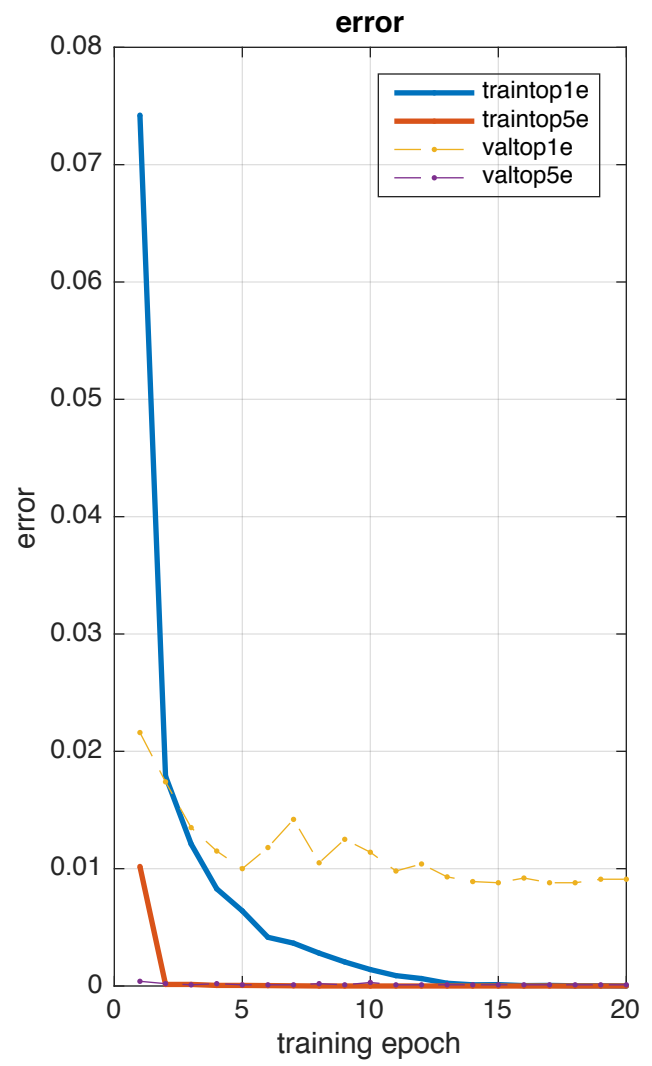
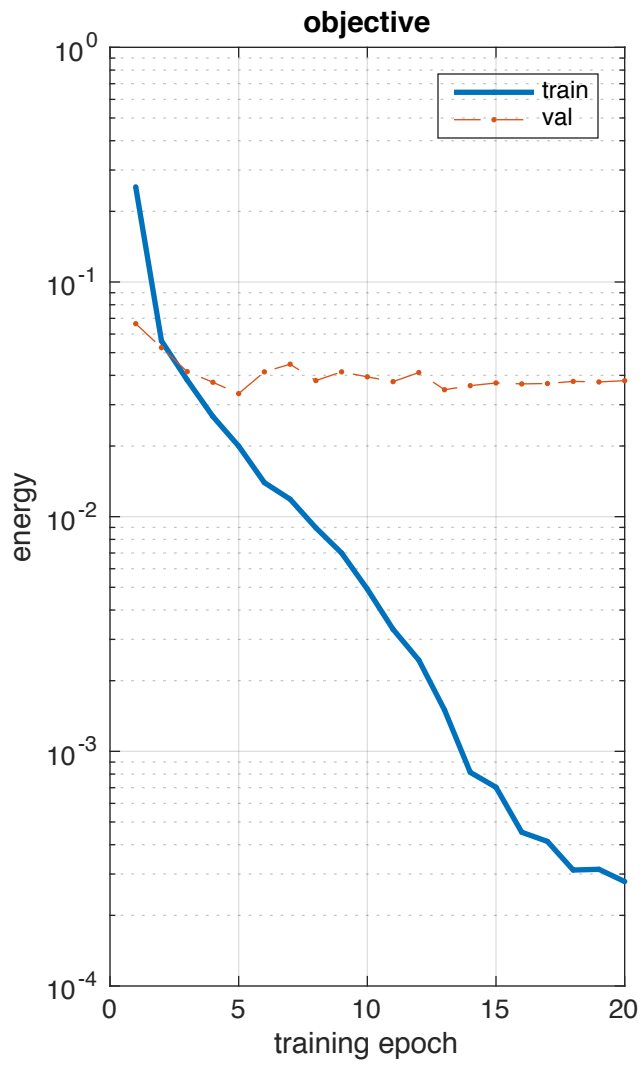
## cifar Original Lenet





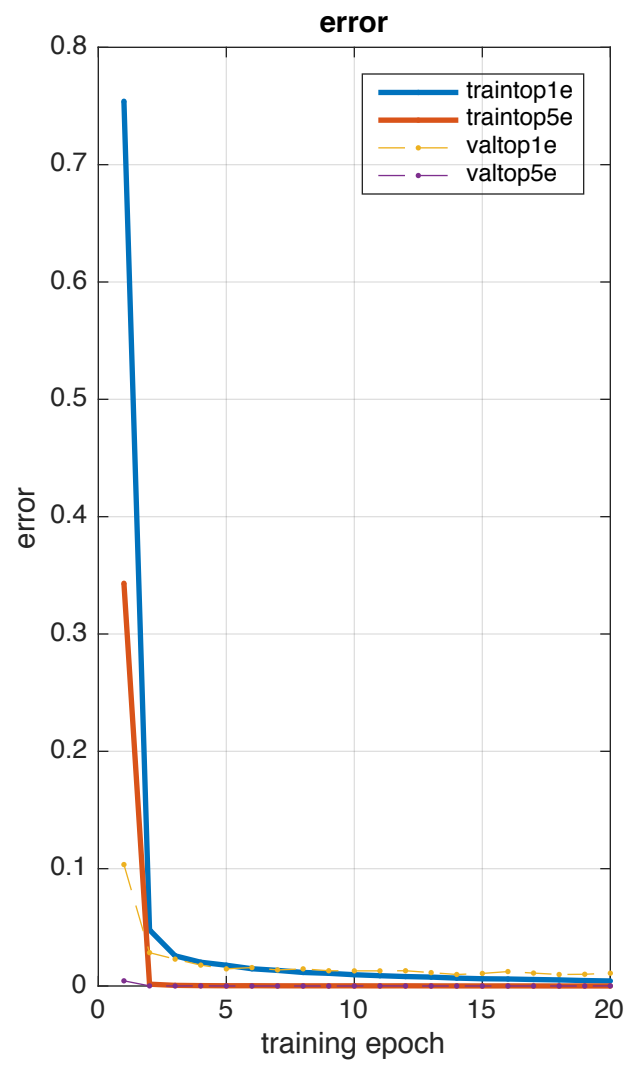
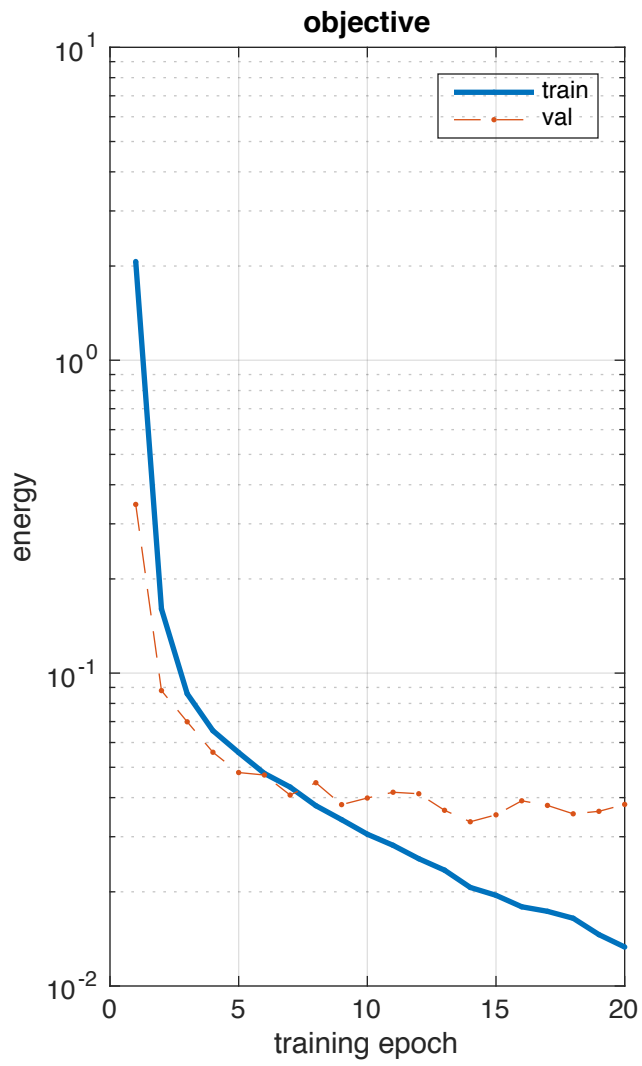
1B

## mnist Original Baseline



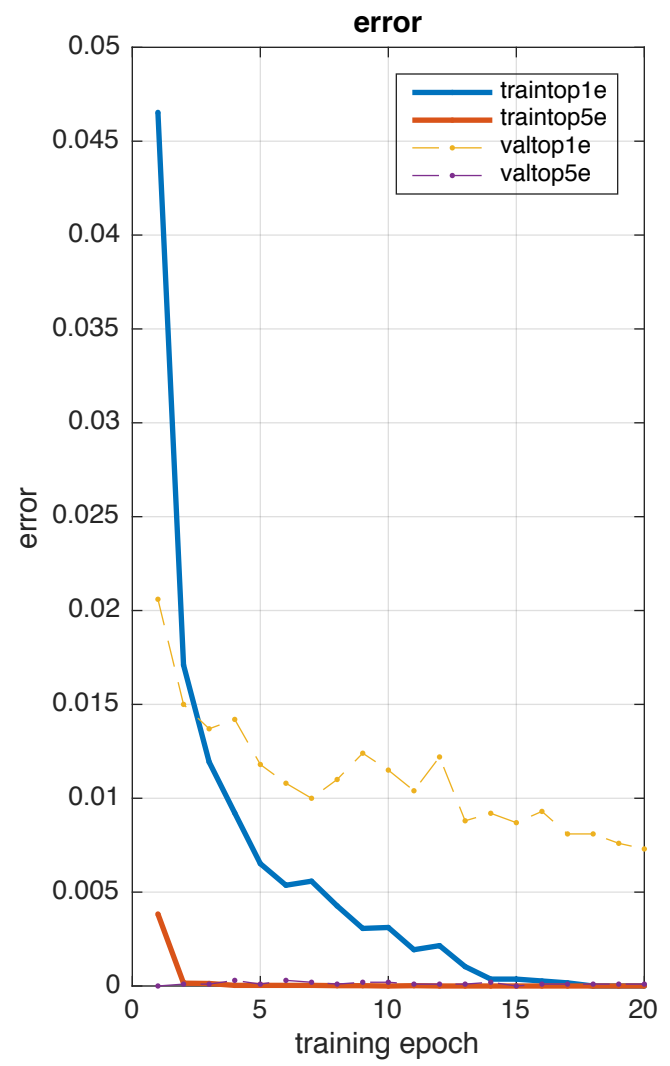
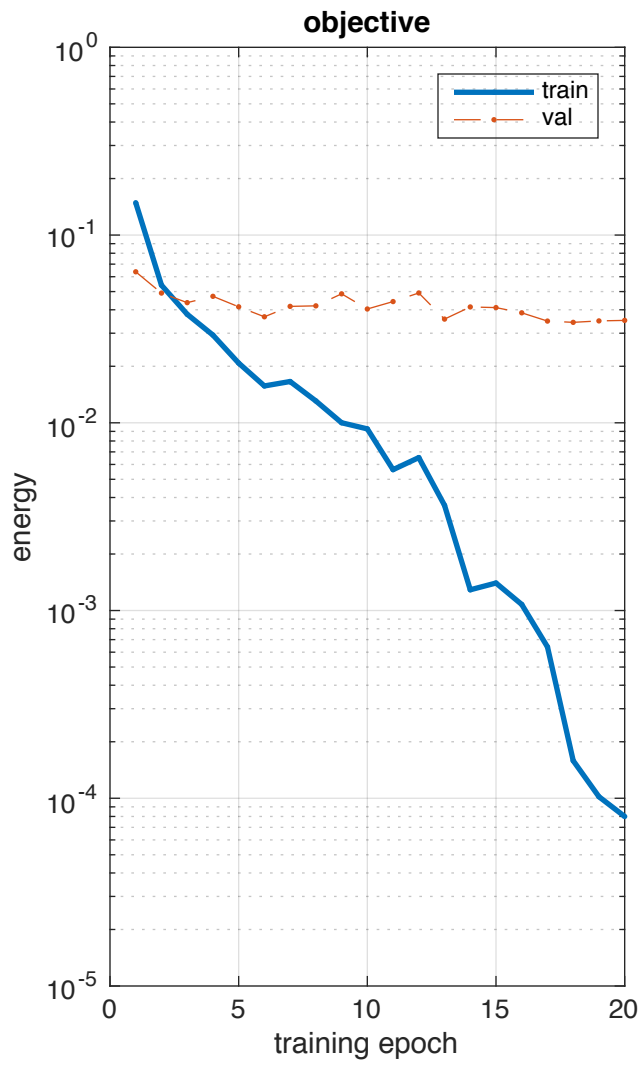
# mnist Shallow Results

1C - B



# mnist Deep Results

1C - B



## 1C-C Explanation

The objective function for the deep network is more jagged than the smooth result of the shallow objective function (and in comparison with the original mnist, whose trajectory is somewhat of a smoother version of the deep network) and reaches a lower ultimate value than the other two. However, it requires many more parameters than the other two (see the 1C-A calculation).

In comparison, the error function for all three ultimately do converge to the same value, but the deep network has a faster convergence rate, especially when compared to the shallow net (for  $\text{traintop } 1e$ ).

## Q2A - Training SVM

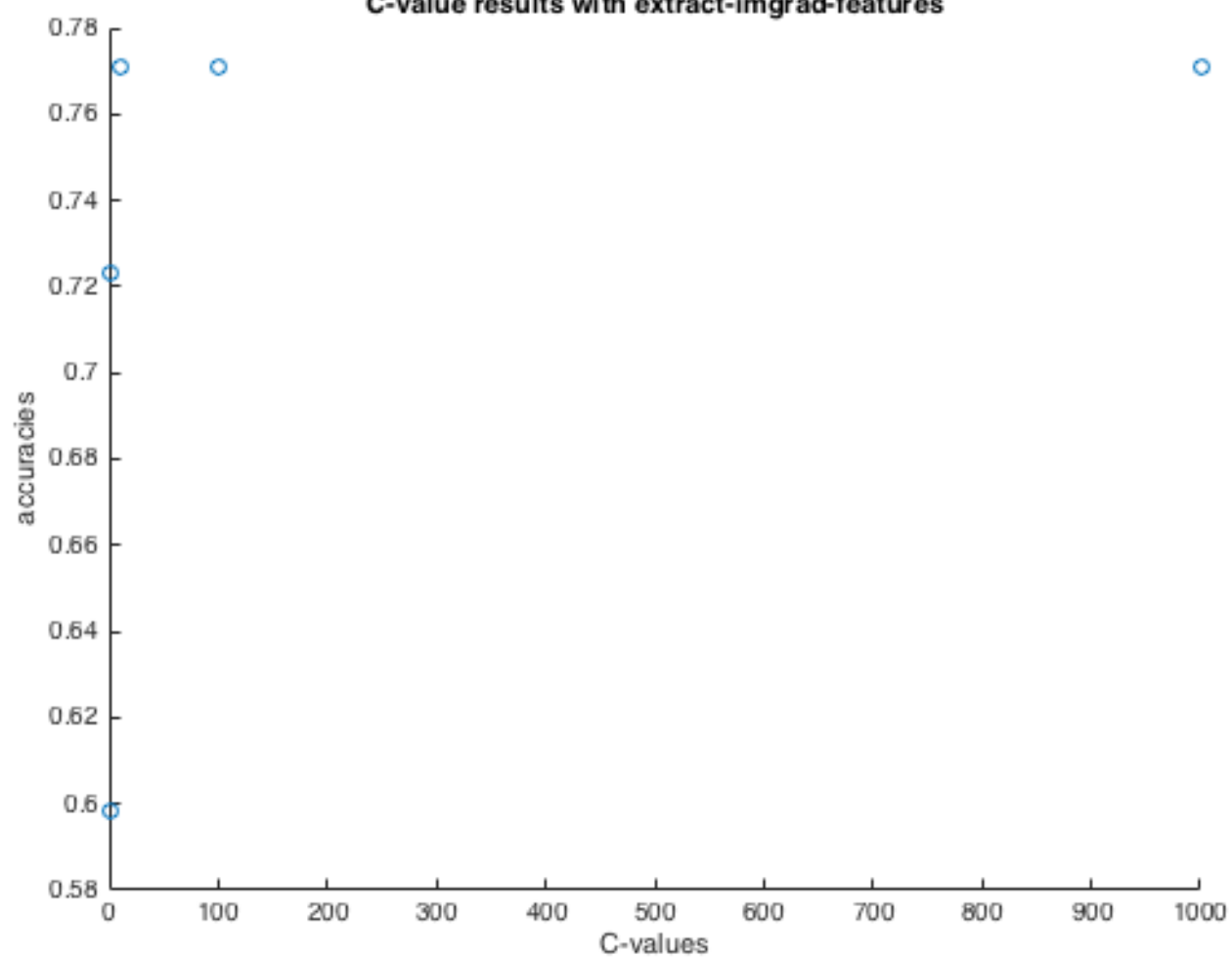
Image Gradients  
Accuracy = 0.7229

Hog Features  
Accuracy = 0.9036

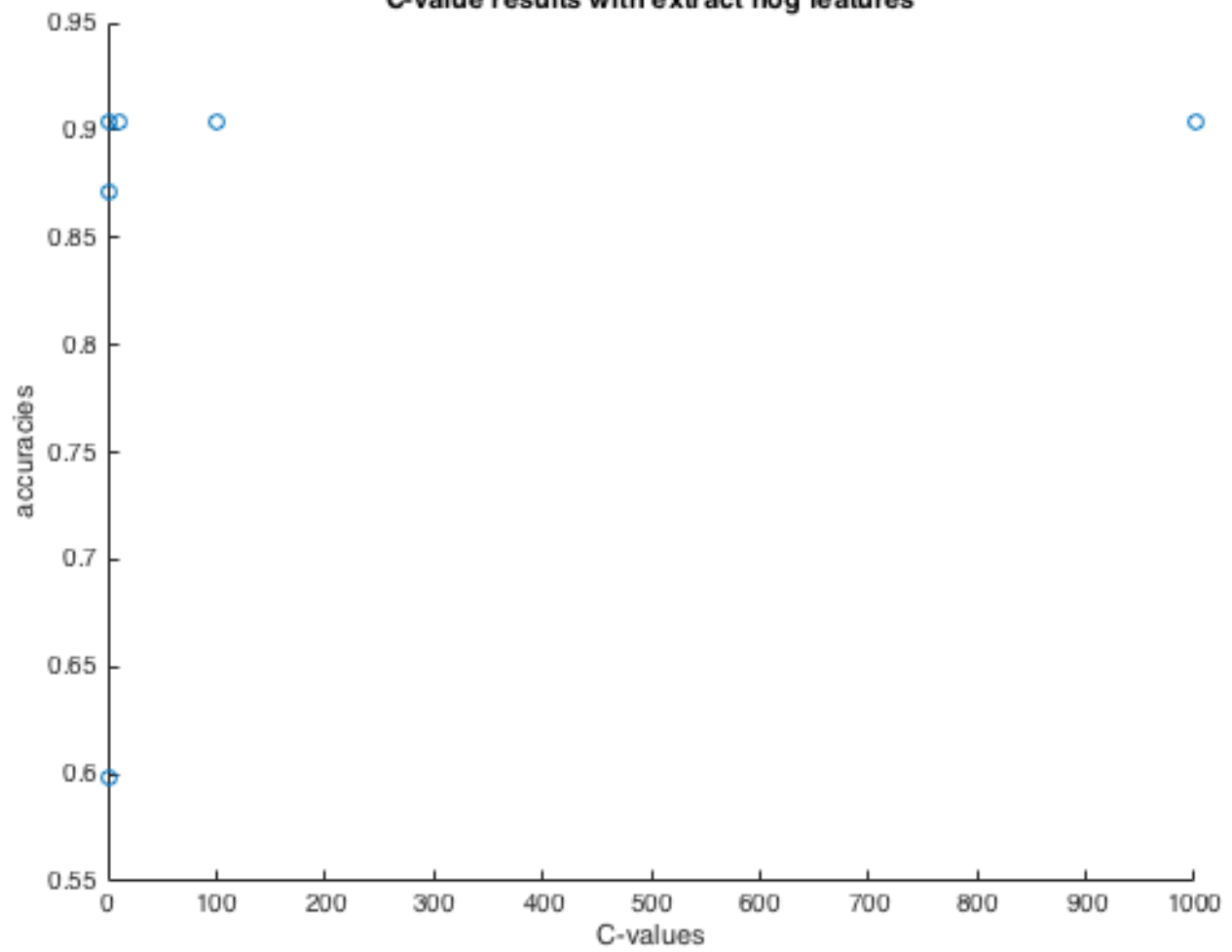
FC7 Features  
Accuracy = 0.9398



**C-value results with extract-imgrad-features**



**C-value results with extract hog features**



**C-value results with extract-vgg-fc7-features**

