

CAP 4453 (Face-to-face) ROBOT VISION PracticeTest TWO 28 points

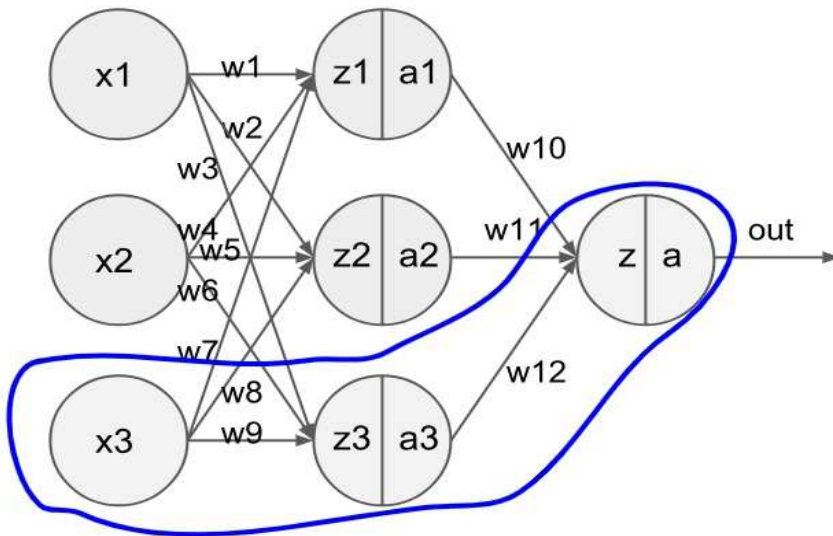
1. (2 points) State three possible project topics (give the title for each of three research papers) for this class.

2. (4 points) Consider the following neural network with 3 inputs x_1 , x_2 , and x_3 , 1 hidden layer with 3 neurons and a single neuron in the output layer. Weight parameters in the network are denoted as w_1, w_2, \dots, w_n .

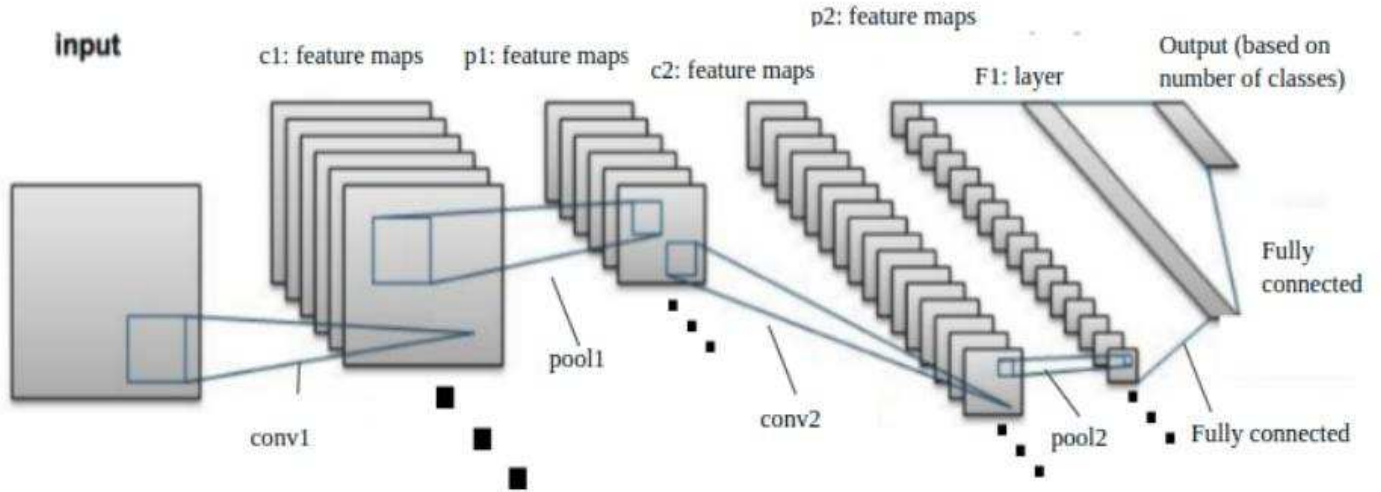
Write down the partial derivatives (using chain rule) for nodes in the highlighted subgraph, i.e., $\partial E/\partial w_{12}$ and $\partial E/\partial w_9$.

Where E_{total} is the sum squared error.

$$E_{total} = \sum (1/2) (target - output)^2$$



3. (6 points) Note: In the figure below, 3 dots means the number of maps will be specified in the sentences.



Given:

- Size of input image to the network is $48 \times 32 \times 1$. ($W \times H \times D$)
- Conv1 - Number of filters = 10, filter size = $(5, 5, 1)$, stride = 1, padding = 2
- Pool1 - filter size $(2, 2)$, stride = 2, padding = 0
- Conv2 - Number of filters = 24, filter size = $(3, 3, X1)$, stride = 1, padding = 0
- Pool2 - filter size $(2, 2)$, stride = 2, padding = 0
- F1 layer - 120 Neurons

Helpful formulas: In formulas below, W is width of array, H is height of array, F is filter size (assumed to be same as its width and height), P is padding, S is stride.

- After conv layer operation, the width of feature maps is given as $(W - F + 2P) / S + 1$.
- After conv layer operation, the height of feature maps is given as $(H - F + 2P) / S + 1$.
- After pooling layer operation, the width of feature maps is given as $(W - F) / S + 1$.
- After pooling layer operation, the height of feature maps is given as $(H - F) / S + 1$.

Answer the following questions:

- What would be the dimensions of feature maps after conv1 operation? _____
- What would be the dimensions of feature maps after pool1 operation? _____
- Determine the value of $X1$ in conv2 filter? _____
- What would be the dimensions of feature maps after pool2 operation? _____
- What would be the size of feature vector after **flattening** operation? _____
- Calculate number of weight parameters between flattened layer and hidden layer? (How many?) _____

