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NPTEL (https://swayam.gov.in/explorer?ncCode=NPTEL) » Deep Learning for Computer Vision (course)

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Course outline

Week 4: Assignment 2

Assignment not submitted **Due date: 2023-08-23, 23:59 IST.**

1) Match the following: ***1 point***

1) Dense registration through optical flow	i) Assumption of rigid transformations
2) Wide baseline spatial matching	ii) Detect different instances of same object
3) Rotation in x – y plane	iii) Two degrees of freedom
4) Bag-of-words	iv) Aperture problem
	v) One degree of freedom

- 1→iv, 2→i, 3→iii, 4→ii
- 1→v, 2→ii, 3→iv, 4→i
- 1→iv, 2→i, 3→v, 4→ii
- 1→v, 2→i, 3→iii, 4→ii

2) Which one of the following statements is **false**? ***1 point***

- The difference between VLAD and BoW is that VLAD yields a residual vector
- BoW allows partial matching
- Aggregated Selective Match Kernel uses concepts from Hamming Embedding method and VLAD
- A codebook or a visual vocabulary consists of visual words

3) Let us consider RANSAC applied on 100 datapoints. Suppose you fit 10 lines $line1 - line10$ at ***1 point*** each iteration time step $t1 - t10$. Number of outliers for each line is given by $[line1 : 80, line2 : 90, line3 : 55, line4 : 60, line5 : 70, line6 : 40, line7 : 50, line8 : 80, line9 : 90, line10 :$ 6
While applying the RANSAC algorithm, which line will be stored as solution at time step $t5$ and $t10$?

- $t5 : line5,\ t10 : line7$
- $t5 : line5,\ t10 : line10$
- $t5 : line3,\ t10 : line6$
- $t5 : line4,\ t10 : line6$

4) Given that a geometric transformation requires 2 correspondences between an input image and ***1 point*** the corrosponding transformed image, the degrees of freedom for that respective geometric transformation will be:

- 3
- 4
- 5

- 3 or 4
- 4 or 5

5) Consider 2 images (X and Y) where 2 binarized descriptors from each image are assigned to the same visual word. Given the following descriptors for each image, compute the score using Hamming embedding: ***1 point***

- First Binarized descriptor for image $X(b_{x1}) : [1, 1, 0, 0, 1]$
- Second Binarized descriptor for image $X(b_{x2}) : [0, 1, 1, 1, 1]$
- First Binarized descriptor for image $Y(b_{y1}) : [0, 0, 0, 1, 1]$
- Second Binarized descriptor for image $Y(b_{y2}) : [0, 1, 1, 1, 1]$

Consider the threshold $\tau = 3$.

- 1
- 2
- 3
- 4

6) Consider two 3×3 images x_1 and x_2 such that $x_1 = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 6 & 8 \\ 5 & 11 & 12 \end{bmatrix}$ and $x_2 = \begin{bmatrix} 3 & 2 & 7 \\ 9 & 1 & 8 \\ 4 & 5 & 6 \end{bmatrix}$. ***1 point***

Their corresponding one-hot encoded label vectors are $y_1 = [1, 0, 0]$ and $y_2 = [0, 1, 0]$. Perform mixup data augmentation between x_1 and x_2 given that $\lambda = 0.6$.

- $\tilde{x} = \begin{bmatrix} 1.8 & 2.0 & 4.6 \\ 6.0 & 4.0 & 8.0 \\ 4.6 & 8.6 & 9.6 \end{bmatrix}; \tilde{y} = [0, 0.6, 0.4]$
- $\tilde{x} = \begin{bmatrix} 1.8 & 2.0 & 4.6 \\ 6.0 & 3.0 & 8.0 \\ 4.6 & 8.4 & 10.8 \end{bmatrix}; \tilde{y} = [0.6, 0.4, 0]$
- $\tilde{x} = \begin{bmatrix} 1.8 & 2.0 & 4.6 \\ 6.0 & 4.0 & 8.0 \\ 4.6 & 8.6 & 9.6 \end{bmatrix}; \tilde{y} = [0.6, 0.4, 0]$
- $\tilde{x} = \begin{bmatrix} 5.2 & 4.2 & 3.2 \\ 5.6 & 9.0 & 10.4 \\ 1.4 & 5.4 & 6.0 \end{bmatrix}; \tilde{y} = [0, 0.4, 0.6]$

7) Which of the following statements are **true**?(select all that apply) ***1 point***

- Batch Normalization increases the dependence on weight initialization.
- Any constant weight initialization will result in poor results.
- We cannot use higher learning rates when Batch Normalization is applied.
- Both very large and small weights can cause certain activation functions (sigmoid/tanh) to saturate, leading to small gradients.

8) Consider a simple perceptron f such that $f : \mathbb{R}^4 \rightarrow \mathbb{R}$ which uses tanh as its activation function. The input $X = [0.4, 0.3, 0.8, 0.2]$ and the corresponding weights $W = [1.2, -0.8, 0.2, 0.5]$. Compute the derivative of tanh of z, where z is a linear combination of weights vector W and input vector X. Ignore the bias term. ***1 point***

- 0.87
- 0.82
- 0.78
- 0.35

9) Consider the following statements. ***1 point***

(i) Adding Gaussian noise (with zero mean) to input is equivalent to L2 weight decay when loss function is MSE.

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(ii) At test time, batch normalization uses running average of training mini-batch mean and variance.

- statement (i) is true but statement (ii) is false.
- statement (ii) is true but statement (i) is false.
- Both statements are false.
- Both statements are true.

10) Which one of the following statements is **true**: ***1 point***

- Weight change criterion is a method of 'early stopping' that checks whether or not the error is dropping over epochs to decide whether to continue training or stop.
- L_2 norm tends to create more sparse weights than L_1 norm.
- During the training phase, for each iteration, Dropout ignores a random fraction, p, of nodes, and accounts for it in the test phase by scaling down the activations by a factor of p.
- A single McCulloch-Pitts neuron is capable of modeling AND, OR, XOR, NOR, and NAND functions.

11) Using Adagrad-based gradient descent, find the new value of parameter θ_{t+1}, given that the old value $\theta_t = 0.9$, aggregated gradient $\Delta\theta_t = 0.8$, gradient accumulation $r_{t-1} = 0.5$, learning rate $\alpha = 0.2$ and small constant $\delta = 10^{-8}$. (Round decimal point till 3 places.)

1 point

12) Using RMSProp-based gradient descent, find the new value of parameter θ_{t+1}, given that the old value $\theta_t = 1.8$, aggregated gradient $\Delta\theta_t = 0.6$, gradient accumulation $r_{t-1} = 0.4$, learning rate $\alpha = 0.1$, decay rate $\rho = 0.6$ and small constant $\delta = 10^{-9}$. (Round decimal point till 3 places.)

1 point

You may submit any number of times before the due date. The final submission will be considered for grading.

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