Editorial: Assignment-W9A1: Case-Based Assessment on CNNs, Optimizers, and Clustering Fundamentals

Question 1 (MCQ)
A neural network engineer at "InitAI" notices her model's neurons are producing identical outputs during initial training phases.
What fundamental problem does proper weight initialization address in this situation?
A) Feature redundancy
B) Gradient explosion
C) Symmetric learning
D) Computational overhead
Correct Answer: C)
Explanation: Proper initialization breaks symmetry between neurons to enable diverse feature learning.

Question 2 (MCQ)
A data analyst at "CatCluster" needs to segment customer feedback data containing categorical variables like product categories and complaint types.
Which modified version of K-means should she use?
A) K-medoids
B) K-prototypes
C) K-modes D) Fuzzy C-means
Correct Answer: C)
Explanation: K-modes uses mode instead of mean for centroid calculation in categorical spaces.

Question 3 (MCQ)
During an internal workshop at "EpochAI", engineers debate how many times their model should see the full dataset.
What critical concept determines complete iterations through the training data?
A) Batch size
B) Validation split
C) Learning rate
D) Epoch count **Correct Answer:** D)
Explanation: Epochs define full passes through the training dataset.

Question 4 (MCQ)
At "OptiLearn", engineers observe their model either overshooting minima or converging too slowly during training.

Which hyperparameter directly controls the magnitude of parameter updates?
A) Regularization factor
B) Learning rate
C) Momentum
D) Batch size
Correct Answer: B)
Explanation: Learning rate (α) scales gradient steps during optimization.

Question 5 (MCQ)
A research team at "OptiNet" wants an optimizer that not only adapts learning rates per parameter but also incorporates momentum.
Which algorithm provides both momentum and per-parameter adaptive learning rates?
A) SGD
B) RMSProp
C) Adam
D) Adagrad

Correct Answer: C) Adam

Explanation:
Adam maintains running estimates of both the first moment (mean) and the second moment (uncentered variance) of the gradients, combining momentum with per-parameter adaptive learning rates for efficient convergence.

Question 6 (MCQ)
"AugmentAI"'s CNN performs poorly on rotated test images despite good training accuracy.
Which preprocessing strategy would improve model robustness?
A) Data augmentation
B) Weight decay
C) Early stopping
D) Layer pruning
Correct Answer: A)
Explanation: Augmentation artificially expands training data diversity through transformations.

Question 7 (MCQ)
An "OverfitGuard" engineer notices 98% training accuracy but 65% validation accuracy.
Which technique specifically addresses this performance gap?
A) Increase model depth
B) Use larger kernels

C) Reduce batch size
D) Add dropout layers **Correct Answer:** D)
Explanation: Dropout randomly deactivates neurons to prevent co-adaptation and overfitting.

Question 8 (MCQ)
A medical imaging startup needs to preserve tumor location details while processing X-rays. Which CNN component maintains spatial relationships best?
A) Convolutional filters
B) Fully connected layers
C) Global pooling
D) Attention mechanisms
Correct Answer: A)
Explanation: Convolutions process local regions while preserving grid structure.

Question 9 (MCQ)
When designing a real-time object detector for drones, an engineer wants to reduce feature map dimensions by half.
Which stride value achieves this in convolutional layers?
A) 1
B) 3
C) 2
D) 4
Correct Answer: C)
Explanation: Stride=2 halves spatial resolution through 2-pixel step size.

Question 10 (MCQ)
A security camera system needs to detect edge features in low-light conditions.
Which padding method ensures complete edge processing?
A) Valid
B) Same
C) Causal
D) Reflective
Correct Answer: B)
Explanation: "Same" padding (typically zero-padded) preserves spatial dimensions.

Question 11 (MSQ)
An autonomous vehicle team needs to balance computational efficiency with feature

preservation.
Which pooling benefits should they consider? (Select all correct answers)
A) Maintains exact positional data
B) Reduces spatial dimensions
C) Enhances translation invariance
D) Increases channel depth
Correct Answer: B), C)
Explanation: Pooling downsamples features while providing position tolerance.

Question 12 (MCQ)
During filter design, an engineer wants to control activation thresholds for edge detection.
Which parameter provides this adjustment?
A) Bias term B) Kernel weights
C) Stride length
D) Padding size
Correct Answer: A)
Explanation: Bias terms shift activation thresholds independently.

Question 13 (MSQ)
A team optimizing CNN architecture needs to calculate output dimensions.
Which factors directly impact this? (Select all correct answers)
A) Input resolution
B) Learning rate
C) Stride value
D) Optimizer choice
Correct Answer: A), C)
Explanation: Output size = (W-F+2P)/S +1 (W=input, F=kernel, P=pad, S=stride).

Question 14 (MSQ)
When reproducing AlexNet's success, which anti-overfitting strategies should be implemented? (Select all correct answers)
A) Label smoothing
B) Random cropping
C) Dropout
D) Weight clipping
Correct Answer: B), C)
Explanation: AlexNet used data augmentation (cropping) and dropout.

Question 15 (MCQ)

A computer vision engineer processes RGB satellite imagery.

What filter depth is required for first-layer convolutions?

A) 1

B) Matching output channels

C) Equal to batch size

D) 3

Correct Answer: D)

Explanation: Filters must match input channels (3 for RGB).