LM in Artificial Intelligence
Image Processing and Computer Vision
25/06/2025

1) (A) Describe the principle of zero-crossing in the context of edge detection and provide a simple graphical representation to illustrate how zero-crossings indicate edges. (B) Explain which edge detection operator is based on this principle and provide its discrete mathematical formulation in detail. (C) Finally, describe the complete pipeline for performing edge detection using this operator, including where edges are localized in the image.

2) (A) Discuss why we usually optimize a loss, and not accuracy, to train image classification models and derive the generic formula for a loss based on Maximum Likelihood Estimation of the parameters. (B) Motivate mathematically why minimizing the cross-entropy loss is a valid proxy to increase the accuracy of a model. (C) Discuss what is label smoothing and why it may produce models that generalize better than models trained with the plain cross-entropy loss.