KUTAISI INTERNATIONAL UNIVERSITY

Numerical Analysis

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Program Learning Outcomes

Relevant to

- PLO7: an ability to search for, process and analyse information from a variety of sources and to communicate in a professional way orally and in written form)
- PLO5: an ability to design mathematical models in a broad range of intellectual domain
- PLO4: an ability to identify, formulate, abstract and solve mathematical problems applying analytical, symbolic and computatioanl methods together with computing facilities
- PLO3: understanding of limitations of mathematical methods and the constraints on their applicability

Problem 2.1

Digital Images, Edges, and Derivatives (3 points)

1. Define edges and provide examples to illustrate the concept.
2. Explain how derivatives are utilized for edge detection in one and two dimensions. Describe edge indicators and supplement your explanation with visual examples.
3. Investigate the impact of truncation error in finite difference formulas on edge detection. Support your findings with visual evidence.

Please use a separate slide for each of the sub-tasks mentioned above.

Problem 2.2

Digital Images, Features, and Higher Order Derivatives (3 points)

1. Investigate whether higher order derivatives can be employed for edge detection.
2. Explore the potential of higher order derivatives in extracting other features of digital images.
3. Present visual examples to illustrate both successful and unsuccessful findings.

Please use a separate slide for each of the sub-tasks mentioned above.

Problem 2.3

Exploring the Applications of Derivatives (3 points)

1. Provide two illustrations of how derivatives are applied in real-world scenarios.
2. Ensure one of the examples is connected with the concept of edge detection.
3. Present a visual representation for at least one of the examples. Clarify why this application works and mention the tools that can be utilized for this purpose.

Please use a separate slide for each of the sub-tasks mentioned above.

Problem 2.4

Digital Images, Features, and Linear Combinations of Derivatives (3 points)

1. Investigate whether linear combinations of derivatives can be employed for edge detection. Describe the method used to select coefficients in the linear combination of derivatives and justify your approach.
2. Explore the potential of linear combinations of derivatives in extracting other features of digital images. Describe the method used to select coefficients in the linear combination of derivatives and justify your approach.
3. Present visual examples to illustrate both successful and unsuccessful findings.

Please use a separate slide for each of the sub-tasks mentioned above.

Assessment

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- CP is worth 12 points.
- The problem/sub-problem will receive a score of 0 if any of the following conditions are met:
  - The same set of student-defined parameters is used by two or more students.
  - The answer cannot be replicated, for example, the code is not submitted.
  - The solution to the sub-problem is submitted without an accompanying explanation or proof.
  - The code fails to produce correct results when tested on new data.