### Assignment 8

Due on: 04-20-2020, 03:00-07:00

**Course outline**

1. **An Introduction to Wavelets**
2. **The Discrete Wavelet Transform**
3. **Wavelet Analysis in Image Processing**
4. **Wavelet Analysis in Signal Processing**
5. **Applications of Wavelets in Other Fields**

**Week 7: Lectures and Assignment**

**Lecture 7.1: Overview of Wavelets**

1. **Introduction to Wavelets**
2. **Basic Concepts of Wavelets**
3. **Wavelet Transforms**
4. **Applications of Wavelets**

**Lecture 7.2: Wavelet Transforms**

1. **Continuous Wavelet Transform**
2. **Discrete Wavelet Transform**
3. **Wavelet Packets**

**Lecture 7.3: Image Compression**

1. **Wavelet-based Image Compression**
2. **Lossless and Lossy Compression**

**Assignment 8**

The purpose of this assignment is to provide hands-on experience with wavelet transforms and their applications.

1. **Problem 1: Continuous Wavelet Transform**
   - Implement the continuous wavelet transform for a given signal.
   - Analyze the results and discuss the significance of the wavelet coefficients.

2. **Problem 2: Discrete Wavelet Transform**
   - Write a program to perform the discrete wavelet transform on a given image.
   - Discuss the advantages and disadvantages of using DWT for image compression.

3. **Problem 3: Image Compression**
   - Apply wavelet-based compression to an image and compare the results with traditional compression methods.
   - Evaluate the compression performance using metrics such as PSNR and SSIM.

**Guidelines**

- All assignments must be submitted via the course management system by the due date.
- Late submissions will be penalized according to the late submission policy.
- Collaboration is allowed, but each student must submit their own work.

**Submission**

- Submit your code and a report summarizing your findings and conclusions.
- Include any relevant figures or graphs to illustrate your results.

**Grading Criteria**

- Correct implementation of wavelet transforms (40%)
- Analysis and interpretation of results (30%)
- Code quality and presentation (20%)
- Creativity and originality (10%)

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**Table 1: Key Concepts**

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Wavelet</td>
<td>A mathematical function that is localized in both time and frequency.</td>
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<tr>
<td>Continuous Wavelet</td>
<td>A function that is defined over the entire real line.</td>
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<tr>
<td>Discrete Wavelet</td>
<td>A function that is defined only at discrete points.</td>
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<tr>
<td>Wavelet Packet</td>
<td>A complete set of wavelets that spans the entire frequency band.</td>
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<tr>
<td>Image Compression</td>
<td>The process of reducing the size of an image file without losing quality.</td>
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<tr>
<td>PSNR</td>
<td>Peak Signal-to-Noise Ratio; a measure of the quality of a compressed image.</td>
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<tr>
<td>SSIM</td>
<td>Structural Similarity Index; a measure of the similarity between an original and compressed image.</td>
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**References**


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**Assignment Submission**

- Submit your code and report via the course management system by the due date.
- Include all code files and a report summarizing your findings and conclusions.
- Ensure that your submission is well-organized and clearly labeled.

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**Late Submission Policy**

- Late submissions will be penalized according to the following schedule:
  - Up to 1 day late: 5% deduction
  - Up to 2 days late: 10% deduction
  - Up to 3 days late: 15% deduction
  - After 3 days: 20% deduction

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**Follow-up Discussion**

- Please post any questions or concerns about the assignment on the course forum.
- We will hold a Q&A session on the day before the due date to address any remaining questions.

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**Course objectives**

- Understand the fundamental concepts of wavelet transforms.
- Apply wavelet transforms to real-world problems.
- Evaluate the performance of wavelet-based image compression techniques.

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**Teamwork**

- Collaboration is allowed, but each student must submit their own work.
- Please list all team members and their contributions in your submission.