

# DPCM Implementation Report

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## Overview

This project implements Differential Pulse Code Modulation (DPCM) for compressing grayscale images and text using various predictors and quantization levels. The Java code supports three predictor types: Order-1, Order-2, and Adaptive. It applies different quantization levels (8, 16, and 32) to analyze the effects on compression and reconstruction quality.

## Code Structure

- **Main Function:** Interacts with the user to choose between image and text input.
- **Process Input:** Reads the file, applies DPCM encoding/decoding, and computes metrics.
- **Predictors:** Order-1, Order-2, and Adaptive predictors are used for estimating next pixel/character.
- **Quantization:** Residuals are quantized using levels 8, 16, and 32 to study compression.
- **Output:** Saves reconstructed images/text and performance metrics (MSE, Compression Ratio).

## Experiment Setup

For both images and text, we evaluate:

- Mean Squared Error (MSE)
- Compression Ratio (Original Size / Encoded Size)

## Test Case 1: Image Compression

Input Image



Reconstructed Image (Order-2, Quantization Level 16)



## Results

- MSE: **12.83**
- Compression Ratio: **2.46**
- Original Size: **12288 bytes**
- Encoded Size: **5000 bytes**

## Test Case 2: Image Compression

Input Image



Reconstructed Image (Adaptive, Quantization Level 8)



## Results

- MSE: **23.41**
- Compression Ratio: **3.91**
- Original Size: **12288 bytes**
- Encoded Size: **3142 bytes**