Vide Processing

HW1-Motion Estimation

Due: 11/07

Task-Motion Estimation Using Variable Block Size

Objective: To understand the concept of motion estimation using variable block size.

Tasks: Implement a full search algorithm for motion estimation using variable block size. Then determine the best mode.

1. Use three possible block sizes: 64x64, 32x32, and 16x16.

2. Perform the block search for variable block size.

3. Determine the optimal block size according to the RDO (rate distortion optimization). $J = D + \lambda R$

where D :distortion between the current block and its reference block.

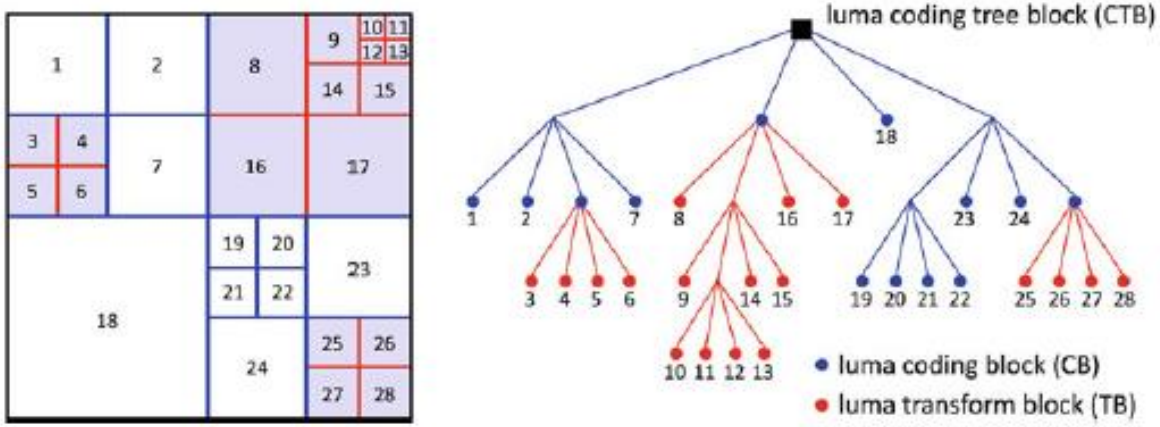
R :bits used to encode this block, including the MV, residual, header…etc.

In RDO, you compare the two costs J_u and J_s where J_u denotes un-split (bigger block) and J_s for split (sum of J of 4 sub-block).

If $J_u \leq J_s$, your decision is unsplit, $J_u > J_s$, your decision is split.

CU/PU/TU in HEVC

- Residual Quadtree Transform (RQT)
  - The recursive partitioning of a coding block into transform block on a quadtree approach.



Deliverables

- A report detailing your implementation and results.(background should be introduced)
- A code that implements the full search algorithm for motion estimation using variable block size.
- Test on two sequences with different activity. Show the predicted frame and the PSNR.
- Note:
  - The distortion can be MAD or MSE.
  - The way to compute the bits is your choice. You must conduct your own research to understand how to estimate the rate without performing transform, quantization and entropy coding.
  - λ should be determined appropriately.

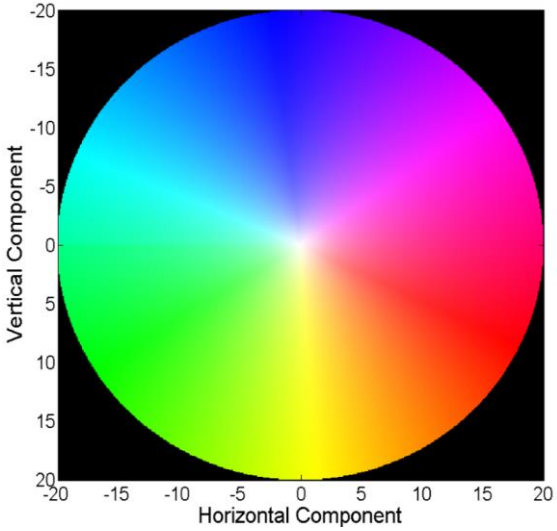
Instructions:

Please carefully read and follow the instructions for the homework assignment:

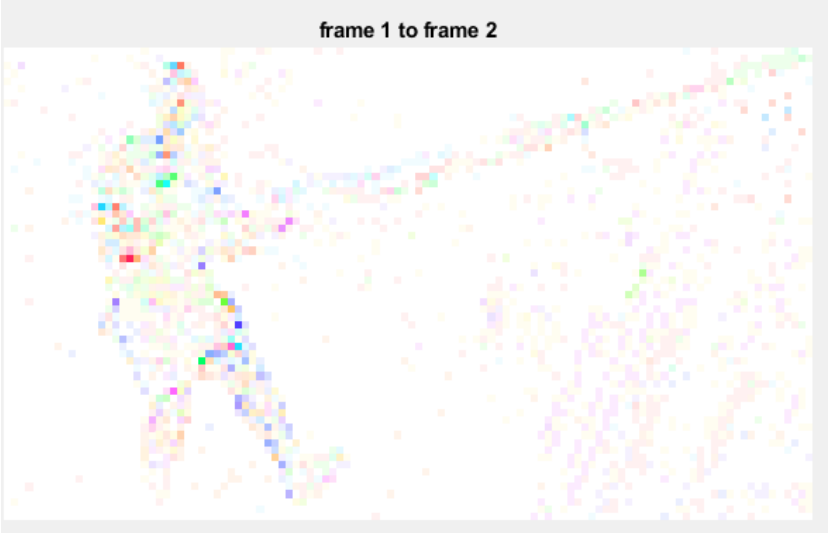
- ✓ Collaboration: This assignment encourages independent research and problem-solving. Collaborate with your classmates for discussion and idea exchange, but each student should submit their unique solutions.
- ✓ AI Guidance: You are encouraged to use AI or machine learning tools to explore solutions to the problems presented in this assignment. The purpose is to leverage AI to gain insights and guidance for further research.
- ✓ References: If you refer to external sources or AI-generated insights, cite them appropriately using the preferred citation style (e.g., APA, MLA).
- ✓ Late Submissions: 10% penalty per overdue day.

Example: Half-pel EBMA


frame 1


-20
-15
-10
-5
0
5
10
15
20
Vertical Component
-20 -15 -10 -5 0 5 10 15 20
Horizontal Component


frame 2


frame 1 to frame 2