

# Exercise Multimedia Technology WS 2004/2005

Sheet 4 (November 19th 2004)

## 4.1 Video compression using MPEG

### 4.1.1 Calculating motion vectors

The gray-scale images *Mogli I* and *Mogli II* shall be given at a resolution of 320x240 pixels. You can download both images as plain ASCII files (mogli\_1.txt and mogli\_2.txt) from:

<http://www.informatik.uni-mannheim.de/pi4/lectures/ws0405/mmtechnik/ueb/data/>



Mogli I



Mogli II

Each pixel is stored as a single number between 0-255 and the gray values of the images have been ordered in the file column-by-column and row-by-row starting in the upper left corner and ending in the lower right corner. In the image above you can see four blocks of size 16x16 pixels (the borders of the blocks are not visible in the image you can download). The left upper corner of each block is located at (32, 32), (32, 128), (256, 32) and (256, 128).

Find out the appropriate motion vectors for the blocks in *Mogli II* that will best match blocks in *Mogli I*. Use a full-search approach with a radius of 16 pixels.

That means that your search area around each block location will have a range between +/- 15 pixels (for each axis).

As you have to compare each candidate block in *Mogli I* with the corresponding red block in *Mogli II*, you will have to calculate the difference. Use the  $L_1$  norm in this case<sup>1</sup>.

#### 4.1.2 P Frames

Explain the properties of P frames with regard to the previous exercise.

#### 4.1.3 B Frames

Explain the difference between P and B frames.

#### 4.1.4 Motion vectors and the optical flow

The optical flow shows how the pixels move between two consecutive frames. Critically comment on the usefulness of the MPEG motion vectors as a predictor for the optical flow.

### 4.2 Wavelet coding

You can download an audiostream as textfile audio.txt. Each number is an 8-Bit sample in ASCII format. You can use the Windows Tool Sound.exe in order to play the file. Decompose the samples into high-pass and low-pass coefficients using the filters from the lecture. Afterwards set all high-pass values to zero whose magnitude is less than 80. What happened to the audio signal after the synthesis?

[www.informatik.uni-mannheim.de/pi4/lectures/ws0405/mmtechnik/ueb/data/sound.exe](http://www.informatik.uni-mannheim.de/pi4/lectures/ws0405/mmtechnik/ueb/data/sound.exe)  
[www.informatik.uni-mannheim.de/pi4/lectures/ws0405/mmtechnik/ueb/data/audio.txt](http://www.informatik.uni-mannheim.de/pi4/lectures/ws0405/mmtechnik/ueb/data/audio.txt)

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<sup>1</sup>The  $L_1$  norm between two values  $x$  and  $y$  is defined as  $|x - y|$