

EEE 6086 Video Processing and Analysis – Model Answers 2013/14

1.

a.

Any three of the following:

Sharpness enhancement

Contrast enhancement

Resolution up-conversion

Picture rate conversion

De-interlacing

De-noising

Coding artefact reduction

The following techniques would need motion estimation:

Picture rate conversion

De-interlacing

b.

50	73	72
49	88	73
51	77	78

30	30	30
30	90	30
30	30	30

c.

-1	-1	-1
-1	9	-1
-1	-1	-1

1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

Rank-order filters are more effective for shot noise.

Median filter

α -trimmed mean filter

d.

K nearest neighbours

Sigma nearest neighbours

Symmetric nearest neighbours

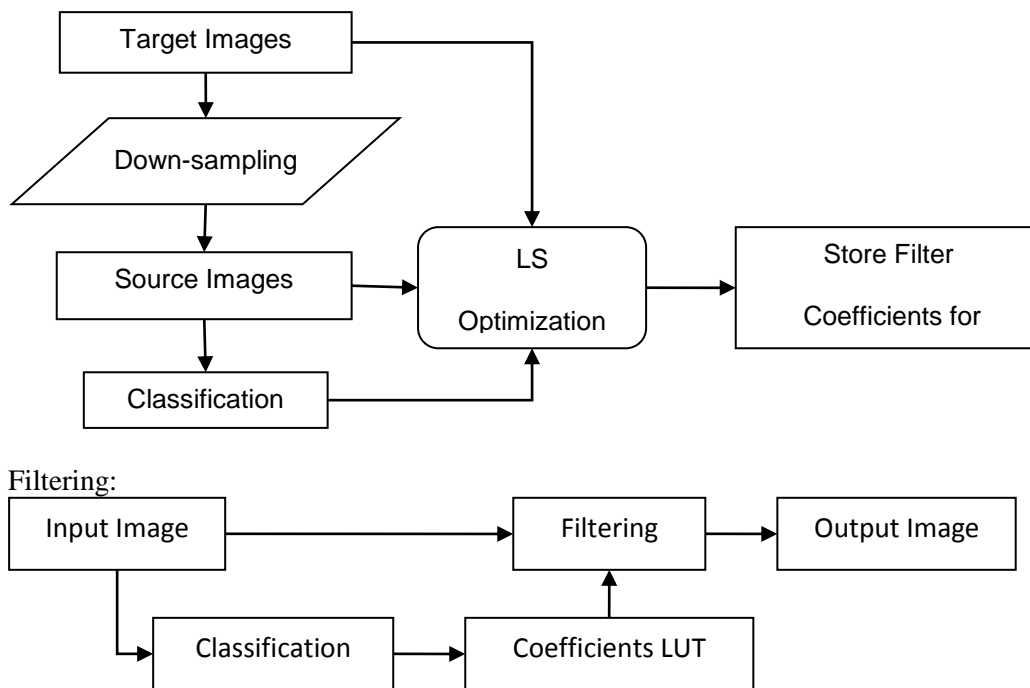
2.

a.

The trained filter can automatically optimise filter coefficients based on classification and offline training. The advantages compared to classical filters include: automatic filter coefficient optimisation, content adaptation and similar architecture for different applications.

b.

Training:



c.

In ADRC, each pixel value is compared to the average. For a pixel value higher than the average, 1 is assigned as the class code for that pixel; otherwise, 0. The final code is the concatenation of the class codes in all the pixels in the neighbourhood.

0	0	1
0	0	1
1	1	1

d.

The drawback of ADRC is that the code length is exponentially related to the pixel number of the support (neighbourhood).

Three methods to shorten the ADRC code:

Bit inversion

Mirror

Rotation

To distinguish horizontal and vertical object edges from the blocking artefact, the structure (ADRC) should be combined with the complexity (activity) measure for classification.

e.

Filter coefficient optimisation in both the trained filter and NEDI is based on least squares optimisation.

The coefficient optimisation in the trained filter is based on an offline training process and classification. The coefficient optimisation in NEDI is done during filtering and based on the assumption that interpolation is scale invariant.

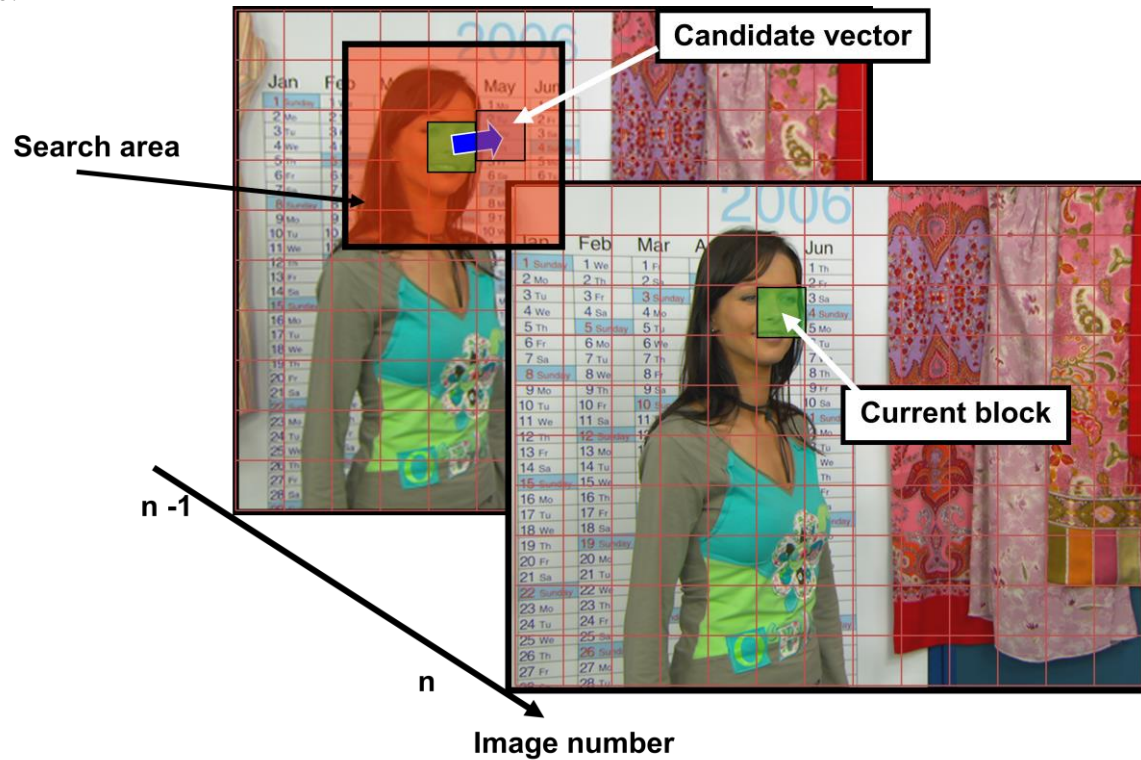
3.

a.

Motion will cause frame repetition to be problematic.

Motion compensated interpolation is usually applied to solve this problem.

b.



c.

Sub-sampled search
One-at-a-time search

d.

Objects are larger than blocks
Objects have inertia

e.

Spatial candidates
Temporal candidates
Update candidates

f.

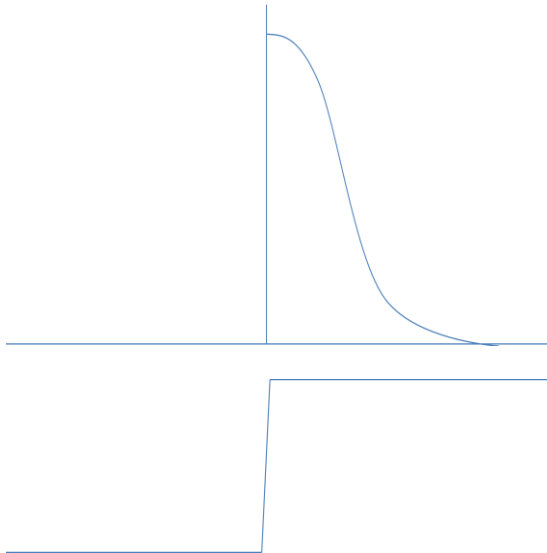
Occlusion

4.

a.

The bilateral filter is an edge-preserving smoothing filter. The weighting coefficients are dependent on both space and range.

b.



c.

The three difficulties of the bilateral filter are:

Poor smoothing in high gradient regions

Smoothes and blunts cliffs, valleys and ridges

Can combine disjoint regions.

Two variants of the bilateral filter are: Trilateral Filter and Joint or Cross bilateral filter.

d.

The non-local means filter searches for similar patches as the current patch and takes advantage of the correlation of image content. The output is the weighted average of those similar patches.

The non-local means filter would work the best on images containing repetitive patterns, such as texture.

e.

The major drawback of non-local means is its efficiency, because searching for similar neighbourhood pixels/patches is time-consuming.

Various efficient search techniques, such as sub-sampled search, can be used to tackle this problem in practice.