

5 Computer Vision (JGD)

(a) Present five experimental observations about human vision that support the thesis that “vision is graphics”: what we see is explicable only partly by the optical image itself, but is more strongly determined by top-down knowledge, model-building and inference processes. [5 marks]

(b) Consider the following pair of (6×6) filter kernels:

-1	-1	2	2	-1	-1
-1	-3	4	4	-3	-1
-1	-4	5	5	-4	-1
-1	-4	5	5	-4	-1
-1	-3	4	4	-3	-1
-1	-1	2	2	-1	-1

1	-1	-1	1	1	-1
1	-2	-3	3	2	-1
1	-3	-4	4	3	-1
1	-3	-4	4	3	-1
1	-2	-3	3	2	-1
1	-1	-1	1	1	-1

(i) Why do these two kernels constitute a quadrature pair? [2 marks]

(ii) To what kinds of image structure, and which orientations, are these detector kernels most sensitive? [2 marks]

(iii) How would these kernels be applied directly to an image for filtering or feature extraction? [2 marks]

(iv) How could their respective Fourier Transforms alternatively be applied to an image, to achieve the same effect as in (iii) but faster? [2 marks]

(v) What is the “DC” response of each of the kernels, and what is the significance of this? [2 marks]

(vi) How could these kernels be combined to locate facial features? [2 marks]

(c) What information about the shape and orientation of an object can be inferred, and how, from the extraction of texture descriptors; and what is the role of prior assumptions in making such inferences from texture? [3 marks]