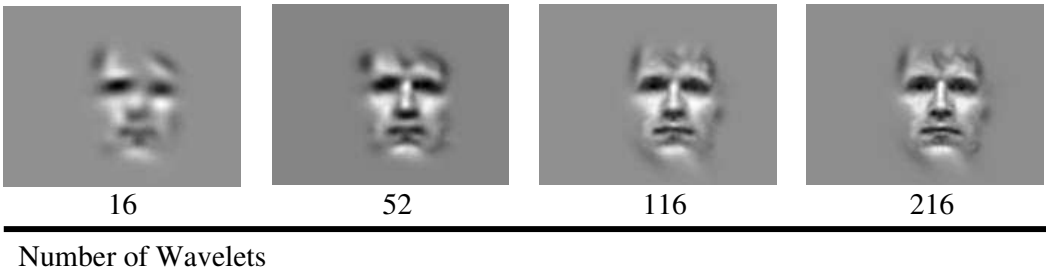
COMPUTER SCIENCE TRIPOS Part II – 2015 – Paper 9

3 Computer Vision (JGD)

(*a*) In human vision, photoreceptors (cones) responsible for colour are numerous only near the fovea, mainly in the central ±10 degrees. High spatial resolution likewise exists only there. So then why does the visual world appear to contain colour information everywhere in the field of view? Why does it also seem to have uniform spatial resolution? Why does the world appear stable despite all our eye movements? Discuss the implications for computer vision principles that might be drawn from these observations. [5 marks]

(*b*) Explain why such a tiny number of 2D Gabor wavelets as shown in this sequence are so efficient at representing faces, and why such wavelet-based encodings are able to deliver impressive accuracy performance in "appearance-based" algorithms for face recognition.



[5 marks]

(*c*) Explain the "receptive field" concept in vision, and what is accomplished by the lateral signal flows within both of the plexiform layers of the mammalian retina, in terms of spatial and temporal image processing and coding.

[5 marks]

(*d*) Machine learning plays an increasingly important rôle in computer vision in a strand of work that may be called "learning to see". Compare and contrast discriminative methods with generative methods for constructing classifiers in computer vision. [5 marks]