

1999 Paper 12 Question 11

Computer Vision

It is often useful in computer vision to represent and analyse image content by means of complex variables, even though an image itself is defined as an array of real numbers. Give at least two distinct examples of useful operations in computer vision based on complex variables, identifying clearly the mathematical domain in which the complex variables exist. Explain in each case what is achieved by adopting such a representation. [10 marks]

In visual pattern recognition algorithms employing complex-valued wavelets, the twin tasks of classification and of discrimination among members of a class are handled differently. When the real and the imaginary parts of wavelet representations are resolved into their complex polar form as modulus and phase, what kind of information is extracted by the modulus? What kind by the phase? Use the examples of detecting faces and of identifying faces to illustrate your answer. [10 marks]