INTRODUCTION

1.1. Introduction

Breast cancer is a major problem for public health in the Western world, where it is the most common cancer among women. In the European Community, for example, breast cancer represents 19% of cancer deaths and fully 24% of all cancer cases. It is diagnosed in a total of 348,000 cases annually in the USA and EC [68] and kills almost 115,000 annually. Approximately 10% of women will develop breast cancer during the course of their lives.

In almost every field of medical imaging other than mammography, clinicians and technicians increasingly rely on computer processing of images as a key part of their decision making. This can involve framing a diagnosis or deciding when to call for further investigation such as a repeat image, an image of a different type, or a biopsy. Images are also used to monitor therapy. This monograph brings together the work we and our colleagues have done over the past few years on attempting to bring the benefits of image processing into mammography.

For the most part, our work to date has been concerned with mammography, which is currently the most frequently performed breast imaging technique done in the clinic. Mammography implies x-ray imaging of the breast. There is an increasing array of breast imaging techniques, including magnetic resonance imaging (MRI), nuclear medicine, and 2- and 3-dimensional ultrasound, and some of these have begun to be referred to as mammography, for example MR mammography. However, we retain the strict usage and so whenever we do not further qualify the term, mammography will mean x-ray breast imaging.

There has been a huge amount of work over the past 30 years developing image processing for mammograms and it has become clear that mammography poses an extremely tough image processing challenge because the images are intrinsically complex and they have poor signal-to-noise ratio. The images are complex because, as we shall see, the breast anatomy is intrinsically complex as is the interaction with it of x-rays, MRI, and the other modalities used in medical imaging. Also, in clinical practice there is always a compromise between patient risk (for example, radiation dose or the amount of contrast agent injected in certain MRI examinations) and