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Book review

Quantitative Analysis in Nuclear Medicine Imaging
Habib Zaidi (ed)
New York: Springer (2006)
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Quantitative analysis has been applied extensively to nuclear medicine images since the invention of the gamma camera about fifty years ago. There have been numerous applications in clinical research, and many of the techniques have also found a place in routine clinical practice. A book dedicated to this topic is very welcome. Although it is a multi-author volume, the editor has clearly had a strong input to many of the chapters, which means that the whole document is generally well coordinated. The 17 chapters are essentially in three parts, although the book is not formally divided in this way: image formation (chapters 1–8), general image analysis methods (chapters 9–13) and specific analysis applications (chapters 14–17).

The strength of the book is in giving a comprehensive description of the current state of the art in the field. Most of the authors are well known leaders in their respective fields. In this respect the book will be very valuable for anyone wishing to embark on a given line of research, as it gives a good up-to-date summary of each area, together with suggestions on where the next directions of research are likely to develop.

This strength, however, means that it may not be the ideal book as a primer for trainee medical physicists, as it does not always start at a basic enough level. To quote an example from the relatively short chapter on planar imaging, the authors explain that they will not be covering the use of broad beam coefficients for attenuation correction of non-scatter corrected planar images. They assume that this is 'old-hat'. However, in reality, this is still very commonly used in clinical practice in both planar and SPECT reconstruction and an understanding of its principle is a very important part of a trainee's curriculum. It should be pointed out, though, that this comment is certainly not true of all the chapters. Those on image reconstruction and registration, for example, are more formal treatments of the subjects and could be used for training purposes.

The first part of the book gives a good description of PET hardware and also both SPECT and PET machines used for high resolution imaging in small animals. The description of animal imagers is very useful background knowledge for those of us working in hospital-based situations who would not normally come into contact with these machines. The description of hybrid SPECT/CT and PET/CT scanners is also very good. The next chapters are on basic image reconstruction methods and the influence and correction of attenuation, scatter and partial volume effects. These tend of necessity to be quite mathematical but are useful systematic treatments of these topics.

As always with multi-author books, the style and approach of different authors varies and this is true in the section on general image processing methods. The chapter on image registration, for example, gives an excellent overview of the different techniques with many examples and a discussion on the important topic of validation. The following chapter on image segmentation, by contrast, focuses almost exclusively on describing the methodology. While this is a comprehensive view of the types of technique used in nuclear medicine image segmentation there is relatively little on applications and validation. There is a useful primer on Monte Carlo modelling, which is becoming an increasingly vital part of nuclear medicine image analysis development. The chapters on tracer kinetics and planar imaging are both quite focused, the kinetic modelling chapter concentrating on PET imaging and that on planar imaging on oncology applications. Nevertheless the descriptions in both chapters contain many of the relevant general principles that apply in these areas of work.

The final part of the book covers applications of quantitative analysis in neurology, cardiology, and oncology. The chapter on neurology imaging is particularly good, giving an excellent overview of the subject including a very understandable description of the principles and operation of statistical parametric mapping. Parameters of cardiac function derived from gated myocardial SPECT are commonly used in clinical practice. The chapter on this topic provides a description of the technology together with a useful summary of the results obtained compared to other techniques. There are separate chapters for diagnostic and therapeutic imaging in oncology. The diagnostic chapter gives a very full account

of the measurement of the body's handling of FDG PET. Although focusing mainly on this example, it provides a very understandable description of a range of techniques for analysing dynamic radionuclide image data, which have other more general applications. The chapter on therapeutic applications primarily covers macrodosimetry with a full description of the MIRD scheme.

The book is generally well-written and easy to read, and is well illustrated. My only comment on this aspect is that the word 'quantitation' appears frequently. Despite the fact it does not appear in the standard dictionary, it is in common use in spoken and written English. The correct word is 'quantification', but perhaps the time has come to accept that common usage should allow 'quantitation' to be included as part of our official language.

The book has been successful in providing a general description of both PET and SPECT imaging analysis. This is useful in that it enables those working primarily in one field to look at what is happening in the other. There is a lot of common ground between the modalities and there is a need for specialists in one field to know what is going on in the other.

I feel that this book is a worthwhile addition to the bookshelves of all nuclear medicine physics groups, providing a useful reference on quantitative nuclear medicine techniques for physics and computing staff at all levels. It is a must for any group wishing to do research in the subject.

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