

Chapter 2

Notation and Terminology

A. Criminisi and J. Shotton

2.1 Notation

The tables below provides a quick reference of the notation and terminology followed in this book. The details will become clear in the following chapters. The invited chapters in Part II follow this convention as closely as possible, but inevitably contain a few minor differences.

Throughout the book, we denote vectors with boldface lowercase symbols (*e.g.* \mathbf{v}), matrices with teletype uppercase letters (*e.g.* \mathbf{M}) and sets in calligraphic notation (*e.g.* \mathcal{S}).

Forest notation

maximum tree depth	D
number of trees in forest	T
index of tree within forest	t
index of split node within a tree	j
sets of data points reaching j th node	\mathcal{S}_j
sets of data points reaching children of j th node	$\mathcal{S}_j^L, \mathcal{S}_j^R$
weak learner (split node) parameters	θ
set of all possible weak learner parameters	\mathcal{T}
subset of params. available at j th node	$\mathcal{T}_j \subseteq \mathcal{T}$
information gain	$I(\mathcal{S}_j, \theta)$
node weak learner/split function	$h(\mathbf{v}, \theta) \in \{0, 1\}$
randomness parameter	ρ
leaf predictor model (categorical)	$p(c \mathbf{v})$
leaf predictor model (continuous)	$p(\mathbf{y} \mathbf{v})$

A. Criminisi (✉) · J. Shotton

Microsoft Research Ltd., 7 J.J. Thomson Avenue, Cambridge CB3 0FB, UK

Data notation

image	$J : \mathbb{N}^2 \rightarrow \mathbb{R}$ ($J : \mathbb{N}^3 \rightarrow \mathbb{R}$ for 3D volumes)
pixel position	$\mathbf{p} \in \mathbb{N}^2$ ($\mathbf{p} \in \mathbb{N}^3$ for 3D volumes)
data unit (feature vector)	$\mathbf{v} = (x_1, \dots, x_d) \in \mathbb{R}^d$
individual feature response	v_i , or $x_i \in \mathbb{R}$
feature response at a given pixel	$\mathbf{v}(\mathbf{p})$
feature selector function	$\phi : \mathbb{R}^d \rightarrow \mathbb{R}^{d'}$ with $d' \ll d$
output label (categorical)	c
output label (continuous)	\mathbf{y}

2.2 Common Terms

Decision forests have a rich literature, and as a result there are several important concepts that are commonly described using multiple terms. These terms will be used somewhat interchangeably in this book, although we will try to focus our attention on one ‘primary’ term for each concept. The table below summarizes a few of these terms.

Our primary term	Other common terms in use
decision forest	randomized forest, random forest, randomized decision forest
decision tree	randomized tree, randomized decision tree
split node	internal node, decision node, branch node
leaf node	terminal node
weak learner	split function, test function, feature
selector function	filter function

Decision Forests for Computer Vision and Medical
Image Analysis

Criminisi, A.; Shotton, J. (Eds.)

2013, XIX, 368 p., Hardcover

ISBN: 978-1-4471-4928-6