Preface

Electrodermal activity (EDA) can be considered one of the most common perceptual channel, of the autonomic nervous system (ANS) dynamics and manifests itself as changes in electrical properties of the skin. Several previous studies have shown how EDA can be a very informative biomedical sign with high discriminant power between different psychophysiological states, although in this case many methodological issues arise. This book fervently shows how to retrieve much reliable information from EDA, to investigate also the assessment of emotional responses in healthy subjects and patients with pathological mood/mental states. Throughout the chapters, in-depth methodological and applicative studies involving EDA are described, including a critical review on the current state of the art. Since continuous deconvolution analysis (CDA) has been recognized as one of the mostly used methods for EDA analysis, we first show how to apply this model to discern different affective states in healthy volunteers. Emotions were evoked using multimodal standardized sets of pictures, sounds, caresses, and smells. Valence and arousal levels of such emotions were identified as the principal dimensions of the affective responses. The achieved results are consistent with the hypothesis that it is possible to objectively study ANS dynamics involved in the emotional processing by properly processing the EDA.

Furthermore, this book reports on a novel computational model for the EDA analysis based on convex optimization methods. This model, hereinafter called cvxEDA, describes the EDA as a sum of the phasic component, the tonic component, and an additive white Gaussian noise term incorporating prediction errors, as well as measurement errors and artifacts. CvxEDA is physiologically inspired and overcomes the limitations of the heuristic solutions and post-processing steps of the conventional approach. It is based on a rigorous methodology grounded on Bayesian statistics, mathematical convex optimization, and sparsity. Building on our previous CDA-based experimental results, outcomes of cvxEDA often demonstrate higher accuracy than CDA while discerning elicited emotional states in healthy subjects. When applied to EDA from psychiatric patients suffering from bipolar

disorder, it is shown how EDA significantly changes according to different mood states. This also allows using EDA phasic and tonic components as suitable markers for discriminating pathological mood states in bipolar patients.

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