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Shapes and Diffeomorphisms

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Shapes and Diffeomorphisms

- Suitable for an advanced undergraduate course in the differential geometry of curves and surfaces, featuring applications that are rarely treated in standard texts
- Provides a graduate-level theoretical background in shape analysis and connects it with algorithms and statistical methods
- Offers a unique presentation of diffeomorphic registration methods, which has no equivalent in the current literature

This book covers mathematical foundations and methods for the computerized analysis of shapes, providing the requisite background in geometry and functional analysis and introducing various algorithms and approaches to shape modeling, with a special focus on the interesting connections between shapes and their transformations by diffeomorphisms. A direct application is to computational anatomy, for which techniques such as largedeformation diffeomorphic metric mapping and metamorphosis, among others, are presented. The appendices detail a series of classical topics (Hilbert spaces, differential equations, Riemannian manifolds, optimal control).The intended audience is applied mathematicians and mathematically inclined engineers interested in the topic of shape analysis and its possible applications in computer vision or medical imaging. The first part can be used for an advanced undergraduate course on differential geometry with a focus on applications while the later chapters are suitable for a graduate course on shape analysis through the action of diffeomorphisms. Several significant additions appear in the 2nd edition, most notably a new chapter on shape datasets, and a discussion of optimal control theory in an infinite-dimensional framework, which is then used to enrich the presentation of diffeomorphic matching.

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