TITLE:
Automatic Segmentation of Mouse Images

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Abstract:

Genetic engineering has enabled the generation of organisms where molecular reactions in response to patho-physiological events can be measured in real-time by means of molecular imaging. This novel technology with the generation of reporter cell systems, that is cells engineered to express a bioluminescent protein in response to selected stimuli, had a major impact in pharmacological research. The recent generation of reporter mice, where the activity of a specific drug can be studied systematically, hold the promise to strengthen preclinical studies, providing a very rapid and comprehensive view on drug pharmacokinetics and activity in whole organisms. To date, a major limitation to the use of in vivo imaging for pharmaco-toxicological purposes resides in the limited throughput of the methodology: even if up to 100 animals can be reasonably processed in a day by some imaging techniques, the analysis of the data, including the identification and quantification of signals belonging to different mouse body areas, requires time and trained personnel, to manually identify specific body areas where drug effects can be measured. For this reason, we have developed an algorithm to automatically identify (segment) the body areas of a given reporter mouse. Automatic segmentation is obtained by combining classical image processing and pattern recognition techniques. The algorithm has been tested on more than 1000 mouse images differing for sex, pose and lighting conditions, and acquired by devices of different companies. Our algorithm, not only increases processivity (the whole dataset analyzed by a trained scientist in a week was processed overnight by our software), but also provides more accurate results. In conclusion, automatic systems may outperform current manual image analysis, allowing to obtain a detailed comprehension of real-time molecular processes in living animals with a standardized, rapid, and cost-effective approach.