Title of the dissertation
Random Search Algorithms for Optimal Control

Contents of the dissertation
This dissertation presents random search algorithms for optimal control. Control problems appear in many application areas, and perhaps the best known of these is robotics. Random search algorithms work robustly and they enable efficient optimization of control problems.

The research of the dissertation has two branches that are closely related. One of the branches introduces a random search version of an algorithm called Differential Dynamic Programming, which dates back to 1960s. Differential Dynamic Programming is one of the most central algorithms in control theory. The other branch of the dissertation presents a real-time capable tree search which utilizes randomness in the search. The search has been augmented by machine learning methods such that it can learn from its past decisions. The tree search was demonstrated to operate in real time in difficult control problems, such as controlling a simulated humanoid character.

The random search version of Differential Dynamic Programming is a significant algorithm from the perspective of control theory because it enables the usage of this classic algorithm in situations which are usually problematic. An example of such a situations is optimizing movement-having collisions. Collisions need special handling without random search.

Reinforcement learning is an area of machine learning, and it has seen major upheavals lately. Real-time capable tree search utilizing randomness is a useful tool to augment reinforcement learning methods. It also offers an alternative to reinforcement learning for certain applications such as physically-based computer games.

Field of the dissertation
Computer Science

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Custos
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