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Artificial intelligence for cloud computing data center management

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Several complex decisions should be performed when efficiently managing cloud computing data centers. In the context of resource allocation, virtual machine placement (VMP) is one of the most studied combinatorial optimization problems with several possible formulations and a large number of existing optimization criteria. In this invited talk a systematic literature review of the VMP problem will be presented, detailing the main taxonomies proposed by the author for classifying research works on this research topic. Considering the computational complexity of the VMP problem as a NP-Hard problem and the large number of virtual machines (VMs) and physical machines (PMs) humans are not able to solve these problems, giving space for artificial intelligence (AI) to replace human decision making. In this context, AI algorithms that guarantee optimal solutions for the problem are unpractical in real-world cloud computing scenarios. Consequently, AI alternatives for solving the problem with relevant requirements such as calculation time constraints, highly dynamic environments with service elasticity and overbooking, as well as uncertainty of parameters could be considered as very relevant techniques for cloud computing data center operations. Additionally, this invited talk will detail a novel two-phase optimization scheme for infrastructure as a service (IAAS) providers, considering AI techniques for determining when a VMP Reconfiguration (through VM migrations) should be practically performed and what to do with cloud services requested during the recalculation period. Finally, some considerations and lessons learned in related research projects will be presented, as well as main identified research opportunities to further advance this very active research area.

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