Neural Networks to Control Nonlinear Underactuated Plants with Uncertainties

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Nowadays neural networks are widely used to solve such problems as object detection, image segmentation, speech recognition, sentiment analysis etc. Considering these tasks, a lot of new layer types and network structures have been proposed recently. And they improved the recognition quality dramatically.

The situation is not the same with the application of the neural networks to the control problems. So one of the aims of this report is to show some reasons for that. Using the model reference adaptive control framework, the following questions will be considered:

1) what kind of uncertainties could be effectively compensated by the neural networks and when they should be used instead of linear-regression-based compensators;

2) what types of neural networks are used to solve the above-stated tasks and what unique properties they provide;

3) how to train them (offline or online) and how to provide the control system stability;

4) why modern deep neural network structures are not widely applied;

5) how to use neural networks to control nonlinear underactuated plants with unmatched uncertainties (a balancing robot is used as an example).