A Data-Driven Neuroendocrine-PID Controller for Underactuated Systems based on Safe Experimentation Dynamics

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Abstract— **This paper presents a data-driven neuroendocrine-PID controller for underactuated systems. Safe Experimentation Dynamics (SED) is employed to find the optimum neuroendocrine-PID parameters such that the control tracking performance and input energy are minimized. The advantage of the proposed approach is that it can generate fast neuroendocrine-PID parameter tuning by measuring the input and output data of the system without using the plant mathematical model. Moreover, the combination of neuroendocrine structure with PID has a great potential in improving the control performance as compared to the PID controller. An underactuated container crane model is considered to validate the proposed data-driven design. In addition, the performance of the proposed method is investigated in terms of the trolley position, hoist rope length and sway angle trajectory tracking. The simulation results show that the data-driven neuroendocrine-PID approach provides better control performance as compared to the PID controller.**

Index terms - Data-driven; neuroendocrine; PID; tracking control; underactuated.