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Tytuł rozprawy doktorskiej:

BEHAVIORAL AND NEURAL INDICATORS OF DETERMINISTIC LEARNING DYNAMICS

ABSTRACT

In reinforcement learning, one uses the outcomes of previous actions to verify the expectations, adjust the behavior and – in consequence – maximize overall rewards and minimize overall punishments. To adjust the behavior in line with the environmental demands, the inappropriate actions have to be evaluated and labeled as erroneous. The role of a critic, informing about the failures in reaching expected outcomes, is ascribed to the error-monitoring system. Neurophysiological studies using EEG signal determined two main ERP components playing crucial role in assessing the appropriateness of the executed actions – the error-related negativity (ERN) and the feedback-related negativity (FN).

The principles of the reinforcement learning as well as its relation to the error-monitoring system have been extensively studied in the laboratory settings. However, up to date research focused mainly on describing the mechanisms of RL using probabilistic paradigms – thus, the environments which are not fully predictable and do not provide certain associations between action and its outcome.

Research presented in this thesis aimed at exploring the dynamics of RL and error-monitoring system in deterministic settings, where the association between the action and its outcome is stable. Presented study implemented the event-related potentials' technique to study the dynamics of error-processing associated with the progress in deterministic learning, and how these processes may be affected by the type of presented feedback and financial gratification, through the two ERP components, the ERN and the FN. For this purpose, new experimental procedure was designed, on the basis of the simple associations learning paradigm – Paired Associate Deterministic Learning task (PADL).

The results show that both, type of feedback information and financial gratification influence the learning process on the behavioral and neurophysiological level. Moreover, data indicates that in the deterministic learning, the dynamics of error-monitoring system activity differs from the one described on the probabilistic model.

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