



INNOVATIONS COMBINING AI AND COMPUTATIONAL NEUROSCIENCE



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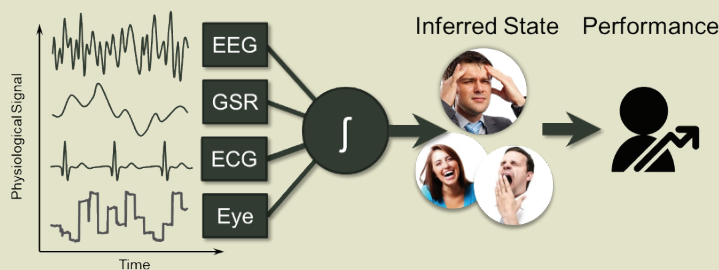
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DCS has collaborated with Army Research Laboratory (ARL) for the past 16 years to advance and apply computational neuroscience approaches to assess physiological signatures of human cognitive state for the purposes of optimizing performance of human-machine integrated system. Advanced Machine Learning approaches were developed to extract and identify cognitive state information from the physiological data. Additionally, generative Artificial Intelligence modeling approaches have been applied to the data by treating derived features of data like words of a written language. All these efforts resulted in novel, groundbreaking innovations and concepts that enable improved team S.A., prediction of performance degradation, and adaptive individualized training.

SOLDIER AS A SENSOR - TACTICAL AWARENESS VIA COLLECTIVE KNOWLEDGE

The Tactical Awareness via Collective Knowledge (TACK) has advanced the “Soldier as a Sensor” concept by developing analytics and AI/ML models that capture real-time insights about the Soldier, Squad, and Environment using minimally intrusive sensors. This work improves how squads measure, predict, and enhance shared situational awareness and understanding, even in volatile and complex operational environments.

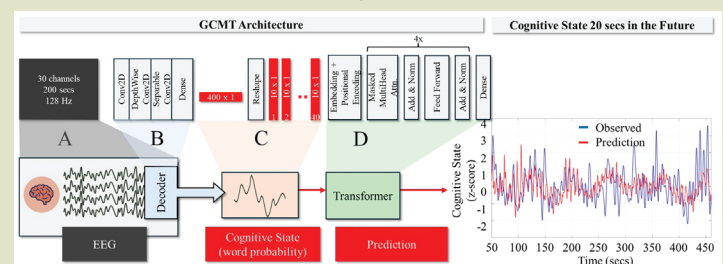


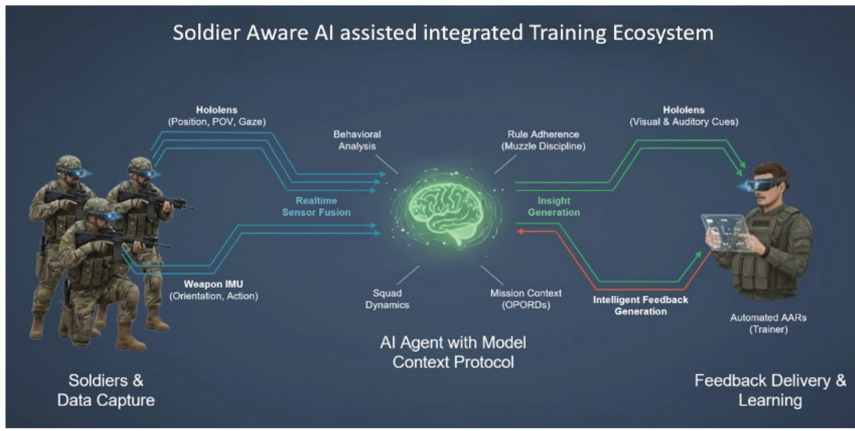
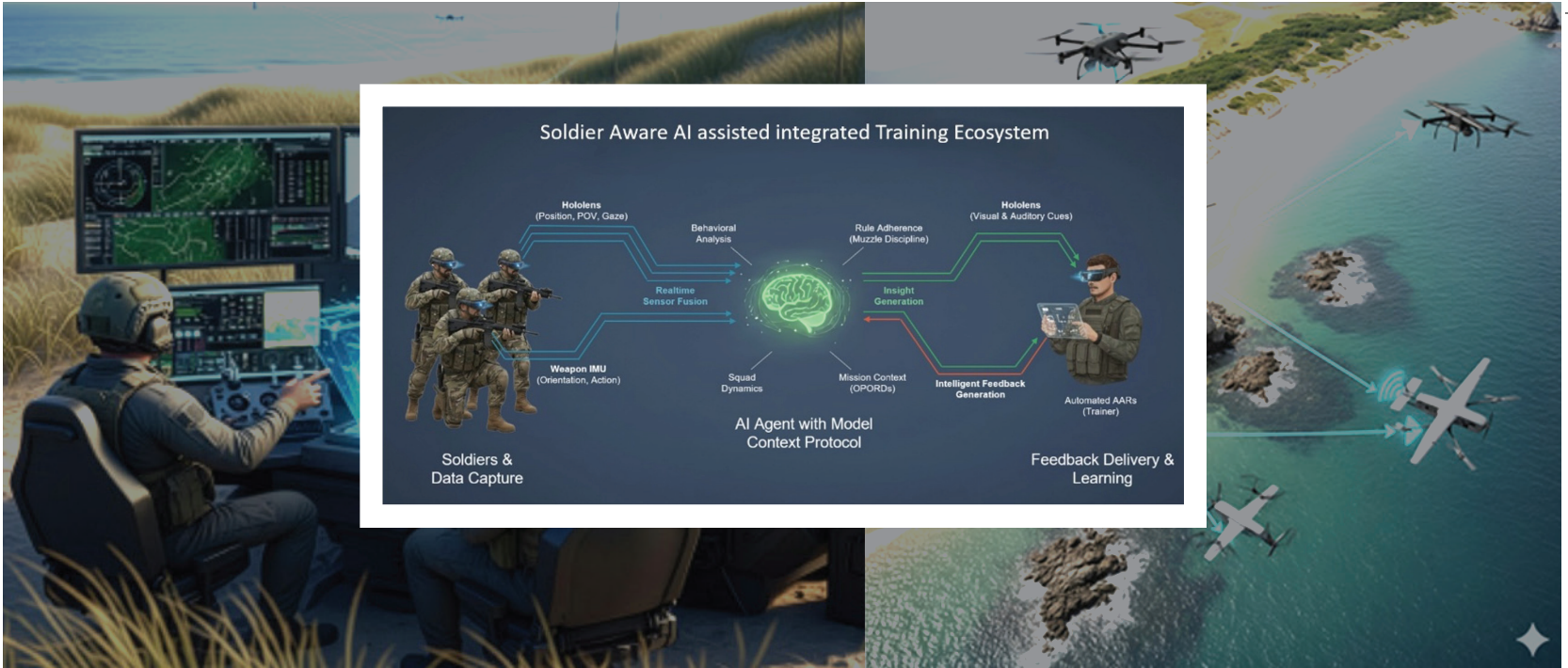
Enders, L.R., Nonte, M., Roy, H., Dankovitch, L., Hoffing, R.C., Perelman, B., Rohaly, T., Dang, T., Stauff, A., Gao, J. and Touryan, J., 2025, Stages of Tactical Response Inferred from Kinematics and Eye-Tracking (STRIKE): Applications for Passive Targeting.

PREDICTIVE COMPUTATIONAL MODEL OF HUMAN PERFORMANCE

The Generative Cognitive Modeling Tool (GCMT) applies generative AI approaches to model oscillatory and environment dependent fluctuations of cognitive state in increments of tens of seconds. This is done by reducing the dimensionality of the physiological data and abstracting away from the specific physiological source to a limited lexicon of internal states.

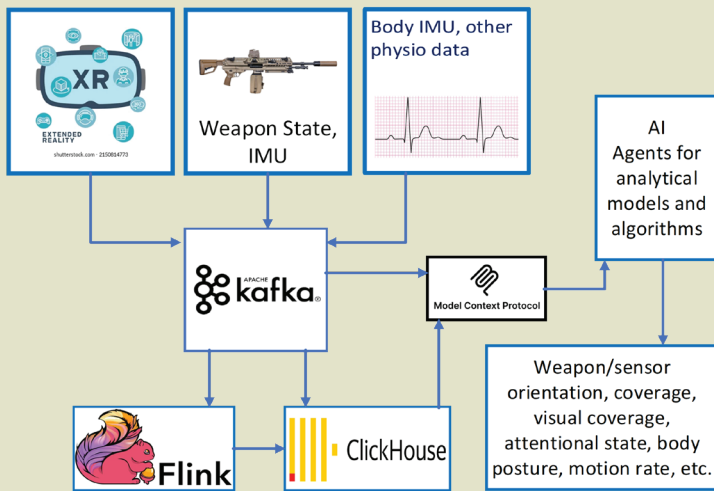
The GCMT learns the “grammatical rules” of this lexicon and has been used to show that 1) sub-minute cognitive resource fluctuations depends on past resource use, and 2) task learning involves phase aligning these fluctuations with environmental demands. Our latest concept uses environmental measures of demand with the GCMT to predict future resource availability.





SOLDIER AWARE AI ASSISTED TRAINING ECOSYSTEM (SAAITE)

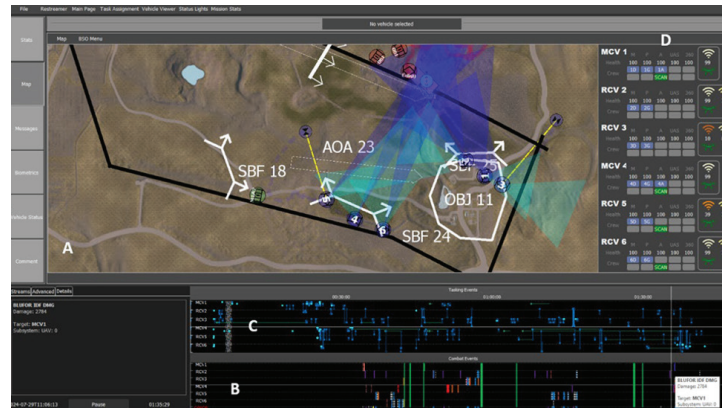
The Soldier Aware AI assisted Training Ecosystem (SAAITE) is a concept developed by DCS that will transform performance feedback for training by exploiting pervasively sensed, opportunistically acquired data from light-weight, Soldier-worn devices and pairing it with AI tools to generate actionable knowledge for training automation. This AI-driven system is designed to greatly enhance the quality and efficiency of performance feedback by adapting to new Desired Learning Objectives, and providing custom generated scenarios that improve learning over time by targeting individual and group failure points.



Rabin, A., Neubauer, C., King, K. and Gordon, S.M., 2024. Using Multi-Modal Physiological Markers and Latent States to Understand Team Performance and Collaboration. *Human Factors in Virtual Environments and Game Design*, p.50.

TOOLKIT FOR CONTINUOUS ASSESSMENT OF TEAMS (T-CAT)

The Toolkit for Continuous Assessment of Teams (T-CAT) is a software that can be deployed in SAAITE for assessing team performance and effectiveness in naturalistic setting. T-CAT provides Soldiers, trainers, testers with the ability to conduct formation-level assessments through data streaming, visualization, event labeling, and annotation.



Krausman, A. S., Baker, A. L., Brewer, R. W., Kelliham, B., Bialek, P., Jagielski, J., ... & Perelman, B. (2025). Toolkit for continuous assessment of teams: Enabling continuous assessment of human-machine integrated formations (HMIF). *STO-MP-HFM-377: Meaningful Human Control in Information Warfare*.

First Place in HP AI Studio & Nvidia Developer Challenge Hack-a-thon for an emotion-aware, multimodal AI system (AffectLink | Devpost), 2025

Dalangin, B., Gordon, S. and Roy, H., 2024. Positive interactions with intelligent technology through psychological ownership: A human-in-the-loop approach. *Artificial Intelligence and Social Computing*, 62.

Gordon, S.M., Dalangin, B. and Touryan, J., 2024. Saccade size predicts onset time of object processing during visual search of an open world virtual environment. *NeuroImage*, 298, p.120781.

Lawhern, V. J., Solon, A. J., Waytowich, N. R., Gordon, S. M., Hung, C. P., & Lance, B. J. (2018). EEGNet: a compact convolutional neural network for EEG-based brain-computer interfaces. *Journal of Neural Engineering*, 15(5), 056013.

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