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Conclusions: iRBD, PD+RBD, and PD-RBD shared the same electrocortical profile to TMS, thus suggesting that this approach may be able to uncover neurophysiological markers of synucleinopathy before its clinical onset and supports the view that iRBD itself is already a clinical expression of neurodegeneration. Translationally, this also highlights the glutamate activity as a new potential therapeutic target for both iRBD and PD. Follow-up studies are needed to further support the impact of RBD in the course of PD.

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MANAGING OPERATOR DROWSINESS: AN EXPERIENCE FROM A BRAZILIAN MINING COMPANY

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Introduction: Feeling drowsy significantly increases the risk of accidents. However, because of drowsiness, drivers are often unaware of their condition, or even believe that in their current state of fatigue they can continue with their activity. This means that drivers can fall into a micro-sleep, long enough to drift out of their lane and generate an occurrence. Unfortunately, accidents caused by drowsy driving tend to be the most serious in terms of bodily injury and even fatalities. At this mining company, among principles and values, the number one value is “Life First”, and based on this premise, in 2014 the Drowsiness Management was implemented as part of the Fatigue Prevention Program. Using the latest generation technologies in real time monitoring of the drivers in their activities, and a set of protocols and control systems, we guarantee immediate action in each sign of drowsiness of the drivers, thus fomenting a rich database that serves as a trigger for individual monitoring by occupational medicine, which we can act preventively and individually, anticipating possible risk situations.

Materials and Methods: This is a exploratory descriptive study. The company developed and improved a methodology for sleepiness management that consists of four pillars: 1st Pillar - Training: Ensures that everyone involved understands the steps, protocols and tools that make up the program. 2nd Pillar - Monitoring: Using technologies that enable the follow-up in time, a dedicated team carries out the monitoring and interventions following the protocols according to the level of each event. 3rd Pillar - Management: This is the partnership that interconnects all the others, and that in the implantation had a great contribution, and currently is responsible for managing all the users as well as guaranteeing the functioning and improvement of the whole structure. 4th Pillar - Health Approach: Carries out directed and individual clinical follow-up, referring for treatment the identified pathological cases as well as providing psychological and social support and promoting programs to encourage quality of life.

Conclusions: Each employee has his or her own unique challenges and this way the service is also personalized, and control measures and routines are developed. As a result we have the mitigation of accidents resulting from drowsiness within the mine operation, as well as the identification of the best working hours for each operator and directing them to the appropriate schedule, and this entire process encourages the employee to seek quality of life in order to improve their diet, exercise and a focus on rest and preparation for the day’s work. In this way the

Acknowledgements: Sleepiness Control Program contributes daily with safety inside one of the most complex mines in the world, monitoring more than 800 people and guaranteeing that all of them return safely to their homes.

MODELING EEG DATA USING DEEP LEARNING FOR AUTOMATIC SLEEP STAGE CLASSIFICATION IN MICE

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Introduction: One of the major difficulties when modelling mouse EEG is the large within-subject and between-subjects variation in the EEG sleep patterns. Additionally, there is a huge variability in how experiments are conducted between laboratories, since each lab usually has different hardware and recording setups. Within a single lab, experiments further differ based on the experimental paradigm, genetic background, disease model, sex and age. Such large variation raises the need for an automatic sleep stage classification model that is robust across experimental paradigms. *U-Sleep* is a recent high-performing state-of-the-art model from the human sleep stage classification domain that has shown exceptional generalizability when tested across unseen external cohorts.

Materials and Methods: Here, we present a *U-Sleep* model adapted from human to mouse sleep. We have used transfer learning to take advantage of the previously learned sleep staging features from humans by initializing the mouse model with pre-trained weights from the original *U-Sleep* model. Our model is trained on pairs of EEG and EMG electrodes from 97 wildtype mice recorded in 5 different laboratories. The data are sampled from 5 data cohorts to obtain a robust classifier capable of achieving a good performance across various laboratories. We further examine how much the model benefits from seeing both the EEG and EMG channels by comparing the performance of *U-Sleep* trained on pairs of EEG and EMG electrodes (*U-Sleep-All*) as opposed to only being trained on either the EEG (*U-Sleep-EEG*) or the EMG channel (*U-Sleep-EMG*) alone.

Results: We report a mean accuracy of 0.89 ± 0.03 when testing *U-Sleep-All* across 4 validation sets, in which each validation set represents data from a different laboratory. We found that *U-Sleep-EMG* obtained a mean accuracy of 0.75 ± 0.05 and *U-Sleep-EEG* reached a mean accuracy performance on 0.88 ± 0.02 when tested on the same 4 validation cohorts.

Conclusions: Our findings demonstrate a robust performance of the three automatic sleep stage classification models (*U-Sleep-All*, *U-Sleep-EEG* and *U-Sleep-EMG*) when tested on wildtype mice from different labs. The small performance difference between *U-Sleep-All* and *U-Sleep-EEG* indicates that the *U-Sleep-EEG* model might be sufficient to learn the sleep-staging patterns for mice. This observation may allow sleep scientists to work with a simpler experimental setup while maintaining similar sleep staging evaluation performance. Although the results are in line with state-of-the-art models, we intend to add additional training to all models to improve classification performance.

It is further of interest to examine whether we can use the three models to predict cataplexy and other disease related sleep stages. We are currently conducting experiments using the three models for predicting sleep stages

in narcoleptic mice, and then examining areas of model disagreement. We hypothesize that the dissociation segments where U-Sleep-EEG predicts Wake and U-Sleep-EMG predicts REM could indicate the occurrence of cataplexy. Utilizing an ensemble-dissociation approach could potentially make it possible to present a model that not only classifies the original sleep stages, but also disease-related stages in mice.

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OBSERVING ULTRADIAN SLEEP DYNAMICS WITH A NON-CONTACT RADAR SENSOR

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Introduction: In a new psychiatric hospital building, a radar sensor was installed in the ceiling of all patient rooms. This sensor can detect body movements without direct physical contact. In previous work, we established that models for wrist actigraphic sleep/wake classification can be adapted for use with contact-free radar data. In the present work, we sought to investigate if another data processing tool known as Locomotor Inactivity During Sleep (LIDS), also originally developed for wrist actigraphy, could be adapted for the radar data and used to study more complex aspects of ultradian dynamics during sleep without requiring any on-body equipment.

Patients in an acute psychiatric ward typically have low or no tolerance for on-body sensor equipment, and the therapeutic task of restoring normal sleep conflicts with the need for close observation of patients at risk of suicide or self-harm. Moreover, objective measures of sleep from this population for the purpose of research and to document response to treatment have typically been unavailable. The simple and fully transparent method explored here, used with contact-free sensor data, could both help improve current clinical practice in this setting, and provide new insights into the sleep of populations where obtaining objective measures traditionally has been challenging.

Materials and Methods: In a controlled trial, twelve healthy young adults resided in the hospital ward over a period of two weeks. The participants were monitored simultaneously with radar and wrist actigraphy for the duration of the study. Four nights per participant also included simultaneous polysomnography (PSG). The LIDS transformation was adapted for the radar sensor and applied to radar and actigraphy recordings. Radar and actigraphy LIDS signals were compared to each other and to reduced-resolution representations of the polysomnographic hypnograms, subjected to a simple harmonic analysis, and examined for trends on a group level.

Results: Radar-derived LIDS were highly correlated with actigraphy-derived LIDS ($r > 0.84$), and both were highly correlated to the PSG hypnogram representations ($r_{\text{radars}} > 0.80$, $r_{\text{actigraph}} > 0.76$). Significant differences were not found between estimates of harmonic parameters. Mixed model analysis revealed similar trends on the group level.

Conclusions: The LIDS technique can be used with data from a contact-free radar sensor. This novel data processing technique could become an important tool for improving sleep monitoring and research by providing a simple and transparent way to study ultradian dynamics of sleep from fully unobtrusive recordings of body movement.

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ON THE USE OF TRANSFORMER-BASED DETECTION MODELS FOR ACCURATE SLEEP EVENT ANNOTATION AND ANALYSIS

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Introduction: The transformer architecture has facilitated major advances within several scientific fields including computational sleep science, where it has excelled in automatic sleep stage classification. However, analysis of sleep patterns also requires accurate annotation of several types of discrete sleep events, such as arousals, sleep spindles, and breathing disturbances. Each event is uniquely characterized by their origin, spatial localization in the polysomnogram (PSG), and signal characteristics in the time/frequency domains, which poses major challenges not only for experienced sleep technicians annotating the sleep study, but also for computer models designed for automatic detection of these events. Sleep event annotation can be posed as an object detection problem, wherein one or more objects in an image are both localized by bounding boxes and subsequently classified. Here, we investigate using state-of-the-art object detection models from the computer vision literature, specifically the Detection Transformer (DETR), for automated PSG event detection.

Materials and methods: We consider different variants of the DETR model for joint arousal (Ar), limb movement (LM), and sleep-disordered breathing (SDB) event detection using a complete PSG, as well as sleep spindle detection using only a single EEG channel. The DETR model consists of a backbone module for generating high-dimensional feature representations, and an encoder-decoder transformer module for generating object predictions based on the outputs from the backbone. Since the original DETR model operates on visual images, we investigate two strategies for input representation (time-domain only, short-time Fourier transform, STFT), as well as different strategies for backbone realization including low-complexity (DC-low), high complexity (DC-high), and pre-trained backbones using feature extractors from state-of-the-art models. We compare DETR-based models to established baseline models (DOSED, SUMO, A7) trained on PSG recordings from the MASS dataset using the MODA sleep spindle annotations for sleep spindle detection, and from the MrOS Sleep Study for arousal, leg movement and sleep-disordered breathing event detection. Performances are compared using F1 scores for each event type.

Results: Using the DC-high model, we found increased Ar ($F1 = 0.71$) and SDB ($F1 = 0.76$), and slightly decreased LM ($F1 = 0.63$) detection performance, when comparing to the baseline DOSED model ($F1_{\text{Ar}} = 0.66$, $F1_{\text{SDB}} = 0.66$, $F1_{\text{LM}} = 0.66$, respectively). Comparing against the baseline SUMO and A7 models for sleep spindle detection, we found similar F1 scores for all three models, however, we found high variability in the sleep spindle predictions between all detection models meaning that different spindles were detected by each model.

Conclusions: Transformer models can be successfully applied in computational sleep science as state-of-the-art event detection algorithms. Merging outputs from multiple event detectors should be explored in future work as a viable alternative.

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OROFACIAL MYOFUNCTIONAL THERAPY IN THE TREATMENT OF SLEEP RESPIRATORY DISORDERS: TECHNOLOGY-BASED STRATEGIES TO ENHANCE ADHERENCE

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Introduction: One of the challenges faced by Orofacial Myofunctional Therapy (OMT) is patient adherence, despite recommendations regarding duration, frequency, and manual recording charts. In this study, the attrition behavior of patients with Obstructive Sleep Apnea and Primary