Real-Time Inference (RTI) Simulator Software: Fatigue Detection Application

Kiman B. Park, Ph.D.

Overview: My RTI-Simulator Software will be a sophisticated tool designed for detecting and analyzing fatigue. This software leverages machine learning models to predict the Karolinska Sleepiness Scale (KSS) based on real-time data inputs.

Features:

1. **Dataset Integration:**
   - My software comes pre-loaded with a dataset provided by open source https://zenodo.org/record/2348892/
   - Users can select specific subject #s to visualize each individual and channels.
2. **Machine Learning Models:**
   - **Random Forest Classifier:** This model is used for predicting KSS using P8 channel.
   - **Support Vector Machine (SVC):** This model is used for predicting KSS using O1 channel.
   - **Long-Short Term Memory (LSTM):** This recurrent neural network is used for predicting KSS with all channels.
3. **Real-Time Inference Simulation:**
   - A dynamic simulation feature displays real-time inferences in a dedicated blue window.
   - As data is captured, real-time KSS inferences are marked with green indicators.
   - If no signal is detected, the KSS is automatically set to 0.
   - An alert system is triggered if the KSS exceeds a threshold of 7, with both visual and auditory notifications. This threshold is user-adjustable.
   - The code can be transferred and integrated easily to other sensors for real-time inference.
4. **Customizable Interface:**
   - Users can personalize the application's appearance through the main menu option "Work Space" -> "Change the style".
5. **Model Parameter Viewing:**
   - Detailed model parameters can be accessed via the menu by selecting "Parameters" and choosing either RF, SVC, or LSTM models.
6. **Logging System:**
   - A comprehensive logging system is integrated, accessible through the menu for review.

Technical Specifications:

1. **Operating System:** Windows 10

2. **Programming Language:** Python 3.11
3. **Dataset:** Provided by Open Source Zenodo
4. **Real-Time Data Processing:** Visual and auditory alert systems based on threshold settings

Conclusion: The RTI-Simulator Software will provide an advanced and user-friendly solution for fatigue detection and analysis, featuring robust machine learning capabilities and real-time data processing. The application's customizable interface and adjustable parameters make it suitable for a wide range of users, from researchers to practitioners in various fields.