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**בית הספר להנדסת תעשייה ומערכות נבונות**
הפקולטה להנדסה
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# PulseFormer: A Self-Supervised Transformer Framework for Heart Rate Time Series Modeling

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https://tau-ac-il.zoom.us/j/83251482591?pwd=eEZ27bp3nZXXvyiyht5oknrJ2w5Vye.1

## Abstract:

Heart rate (HR) is one of the most informative physiological signals, offering a non-invasive window into an individual's overall health status. Consequently, continuous HR monitoring and temporal modeling can enable early detection of a wide range of health and wellbeing conditions, including physiological anomalies and disease onset. However, working with HR data at scale presents substantial challenges: it is high-dimensional, often noisy, contains missing segments, and labeled datasets are typically small.

In this study, we introduce *PulseFormer*, a transformer-based framework for learning compact and transferable representations of HR time series via self-supervision. The model is pretrained on a relatively large-scale dataset from the PerMed study, comprising hundreds of thousands of person-days of HR data. During pretraining, PulseFormer jointly optimizes three objectives: (i) imputing masked sequence segments, (ii) forecasting next-day HR values, and (iii) reconstructing unmasked data (autoencoding) — all without requiring labeled annotations. After pretraining, the learned representations can transfer seamlessly to a variety of downstream tasks, even when only a few labeled examples are available.

We evaluate PulseFormer along three complementary axes: (i) imputing missing HR segments, (ii) forecasting next-day HR values, and (iii) two downstream taks — early detection of COVID-19 infection and fever onset (temperature > 37.5°C). In all the considered settings, PulseFormer outperforms existing benchmarks. These results highlight the promise of self-supervised temporal modeling to enable robust, sample-efficient health inference from large-scale heart-rate data.

## Bio:

Ron Elias, is an MSc student in industrial engineering and a deep learning researcher at the Big Data Lab, under the supervision of Prof. Erez Shmueli.