

SynRhythm: Learning a Deep Heart Rate Estimator from General to Specific

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Pro	b	em

> Problem: Remote heart rate (HR) estimation from face video



Hand-crafted feature

Learning-based representation

Pros:

> Strong modeling ability

Motivation

- > Learning-based methods, especially deep convolutional neural networks (DCNN), have shown great power in modeling complicated variations in a number of computer vision tasks, such as object detection, and face recognition.
- > The challenges of applying deep learning for remote HR estimation lie in that there is not sufficient data for training a robust DCNN that can generalize to unseen scenarios. The periodical color change cause by HR can be viewed as a one dimensional signal with low PSNR. Such a signal can be simulated using a periodic function. Therefore, we propose to learn a deep HR estimator from general to specific by synthesizing a large number of HR signals.

> Performing well in well-controlled environment

Cons:

Pros:

> Interpretable

- Based on certain assumptions or priors which may not suitable for realistic situation
- Robust in realistic situations

Cons:

- Large-scale data is needed for training a robust estimator.
- > Existing methods for remote HR estimation are mainly based on some certain physical models or skin reflection priors, which may not hold in realistic situations because of various challenges in head movement, illumination variation and recording device.



Proposed Method

> Spatial-temporal HR signal representation

> General-to-specific learning approach with synthetic signal maps

> Transform a video sequence of face to a good spatial-temporal representation





Database	Subject	Video	Video length	protocol
MAHNOB-HCI	27	527	30s	three-fold
MMSE-HR	40	102	30s	three-fold



MAHNOB-HCI



MMSE-HR



Performance on MAHNOB-HCI





Performance on MMSE-HR

Effectiveness of synthetic data