Presage Breathing Metrics for Spot Model Card

Model Details

Basic info:

Presage vitals by video analysis generates breathing rate metrics such as breath rate and breath trace from a video clip containing a subject's face and chest. An API has also been developed to allow users easy access to compute these metrics for commercial and scientific applications.

Organization developing model: Presage Technologies

Model date: 20250428t162129

Model version: 1.1.0

Model type:A deterministic computer vision model with two primary stages. The first identifies and tracks key feature points on the subject's chest. The second stage uses signal processing to analyze the temporal movement of these features to isolate and quantify the physiological breathing trace and rate.

License: The algorithm is currently proprietary, and licenses are granted with predefined agreement.

Where to send questions: Questions can be sent to: support@presagetech.com

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Intended Use

Model uses:

This aggregate breathing rate model was intended for use by qualified clinicians and researchers for the analysis and non-diagnostic utility of breathing and respiration mechanics. It was intended to be used with a video from a stationary device (such as a handheld, mobile or laptop camera), that contains the subject's face, chest and shoulders in view, and be of at least 15 consecutive seconds in length with at least 5 fps in frame rate. The user's face, chest and shoulders must be unobstructed for at least 15 consecutive seconds within the video. It is only intended to measure breathing rate values in the range of 8-31 bpm.

Out-of-scope uses:

Presage breathing rate and breathing trace model is not intended for diagnostic purposes. Do not self-diagnose or self-medicate on the basis of the measurements. No alarms are provided, and it is not an apnea monitoring or apnea detection model. It is currently not intended for use in highly dynamic environments, or with a highly moving camera. We ensure all users have acknowledged and agreed to our license agreement and terms of service for usage prior to use.

Factors

Breathing metric model first requires Mediapipe's face detection algorithm to identify the face and pose of the subject. Thus, if these features are not identifiable by Mediapipe's algorithm, then breath metrics will not be calculable.
These factors can affect the ability to detect the subject's face and pose. Reference the Mediapipe model cards can be found here: Full Range Face detection model card and lite pose detection:

- **User:** User's face orientation must be within angular parameters for detection by Mediapipe, off axis view decreases model's detection abilities. User's face and chest must be sufficiently visible, illuminated and positioned within the imaging window. User's face and body must be clear, and not blurry due to excessive motion or camera system. Users are instructed to maintain a fixed position.
- **Environment:** Model is trained on images with various lighting, noise and motion conditions and with diverse augmentations. However, its quality can degrade in extreme conditions.

These factors can affect model performance:

- **Lighting:** Temporal changes in lighting and illumination can affect the ability to correctly track key feature points.
- **Clothing:** Dark solid shirts especially in low lighting conditions have shown to be challenging for feature tracking.
- **Motion:** Breathing model cannot tolerate large degrees of non-physiological subject motion. Additionally, subject talking tends to lead to irregular breathing patterns and non-fixed breathing rates. Breathing model cannot handle large degrees of camera motion, instability or

periodic shakiness. It is recommended that both the camera be mounted and the user is in a fixed position before acquiring measurement.

Other factors:

- **Instrumentation:** Several cameras, including mobile (Android), USB (Econ) and webcam (Logi) based devices with varying sensitivities and image resolutions have been tested for efficacy.

Metrics

1. RMSD of point estimate of breath rate: root mean square deviation between all aggregate measured values evaluated over a 30 second period of breath rate and ground truth measurements. This is used because it is an aggregated measure of error that can be easily evaluated against alternative devices. For reference, the predicate device Oxehealth claims 1.17 bpm RMSD.
2. MAE of point estimate and 95% CI of breath rate: median absolute error or deviation of aggregate measurements as compared to ground truth. Unlike RMSD, MAE allows for interpretability of error and distribution of error and is more robust to outliers than mean evaluations.
3. Mean proportion of returned values of breath rate: for every 30 seconds of video, a single weighted measurement can be measured. Of all possible sets of 30 second clips within a video, this is a measure of the proportion of them that returned a valid measurement of breath rate. The breath rate model must be evaluated for accuracy and reliability. For reference, the predicate device Oxehealth claims 73% (95% CI 68% - 79%).

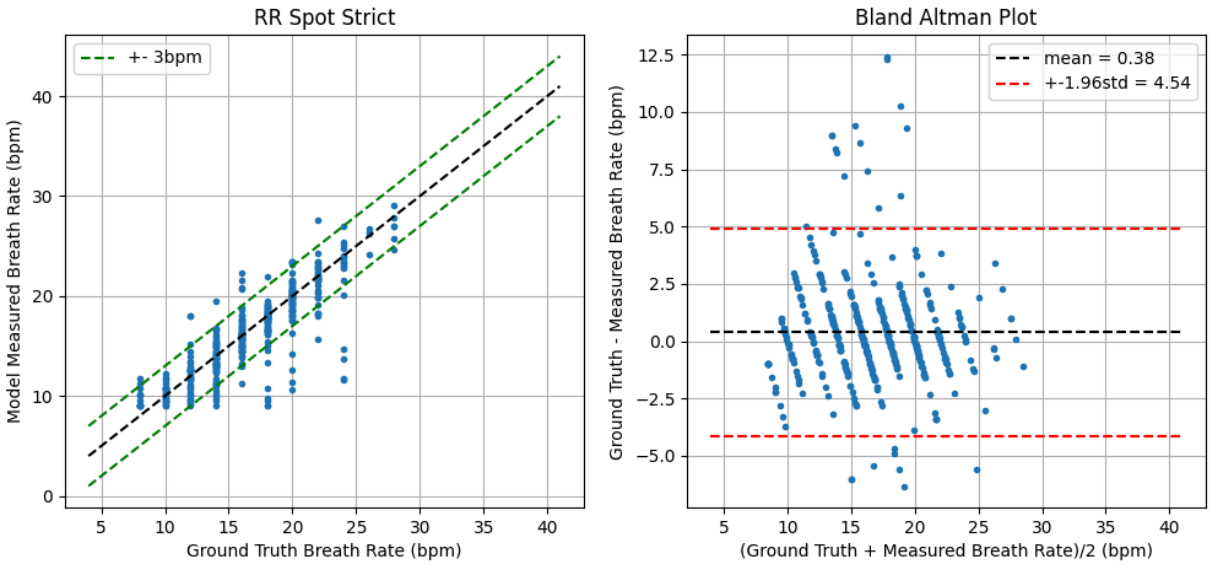
Evaluation Data

The evaluation data consists of a set of 225 videos. Corresponding quantities of breath rate were measured from a Biopac research grade strain gauge breathing sensor. A clip of 30s from each video was run through the Presage breath rate model for evaluation and a single measurement returned, leading to a total number of 661 samples. Each video was acquired on a different user covering a range of demographic variability, including age, gender and Fitzpatrick scale.

Quantitative Data

1. RMSD of point estimate of breath rate: 2.35 bpm
2. MAE of point estimate and 95% CI of breath rate: 1.51 bpm with 95% CI of [1.33, 1.68]
3. Mean proportion of returned values of breath rate and 95% CI: 0.65

Distribution of error figures:



Skin Tone (Fitzpatrick)	% of Dataset (num samples)	RMSD	MAE [95% CI]	Mean Return Rate
1	0.18 (117)	2.61	1.53 [1.33, 1.68]	0.69

Skin Tone (Fitzpatrick)	% of Dataset (num samples)	RMSD	MAE [95% CI]	Mean Return Rate
2	0.15 (98)	1.88	1.38 [1.33, 1.68]	0.67
3	0.09 (61)	2.31	1.73 [1.33, 1.68]	0.49
4	0.15 (99)	1.88	1.24 [1.33, 1.68]	0.55
5	0.11 (75)	2.14	1.46 [1.33, 1.68]	0.71
6	0.14 (95)	1.78	1.29 [1.33, 1.68]	0.77

Sex	% of Dataset (num samples)	RMSD	MAE [95% CI]	Mean Return Rate
M	0.35 (234)	2.30	1.48 [1.33, 1.68]	0.62
F	0.47 (311)	1.99	1.37 [1.33, 1.68]	0.68

Camera Type	% of Dataset (num samples)	RMSD	MAE [95% CI]	Mean Return Rate
Android	0.49 (323)	2.43	1.56 [1.33, 1.68]	0.73
Econ	0.51 (338)	2.24	1.44 [1.33, 1.68]	0.58

Ethical Considerations

As a remote sensing device, the risks posed to the subjects in the trial are minimal, including the association of each subject with corresponding biometric data. Mitigation of these risks include de-identifying all subject data, including videos, prior to saving it. Additionally, all data is securely stored in a HIPPA compliant database with access to a select number of trained researchers.

The model is not intended for human life-critical decisions, diagnostics or prognostication.

Limitations and Tradeoffs

- Works best in stationary conditions (subject and measurement device are stationary)
- Requires at least 15 seconds of uninterrupted and unobstructed view of subject’s face and chest area
- Currently only measures a single subject at a time