



This is a repository copy of *0573 Screening for obstructive sleep apnea at home based on deep learning features derived from respiration sounds.*

White Rose Research Online URL for this paper:  
<https://eprints.whiterose.ac.uk/161507/>

Version: Accepted Version

---

**Proceedings Paper:**

Romero, H.E., Ma, N. [orcid.org/0000-0002-4112-3109](https://orcid.org/0000-0002-4112-3109), Hill, E.A. et al. (1 more author) (2020) 0573 Screening for obstructive sleep apnea at home based on deep learning features derived from respiration sounds. In: Sleep. 34th Annual Meeting of the Associated Professional Sleep Societies - SLEEP 2020, 27-30 Aug 2020, Philadelphia, PA, USA (online conference). Oxford University Press (OUP) , a219-a220.

<https://doi.org/10.1093/sleep/zsaa056.570>

---

© 2020 Associated Professional Sleep Societies (APSS). This is an author-produced version of an abstract subsequently published in Sleep. Uploaded in accordance with the publisher's self-archiving policy.

**Reuse**

Items deposited in White Rose Research Online are protected by copyright, with all rights reserved unless indicated otherwise. They may be downloaded and/or printed for private study, or other acts as permitted by national copyright laws. The publisher or other rights holders may allow further reproduction and re-use of the full text version. This is indicated by the licence information on the White Rose Research Online record for the item.

**Takedown**

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing [eprints@whiterose.ac.uk](mailto:eprints@whiterose.ac.uk) including the URL of the record and the reason for the withdrawal request.



[eprints@whiterose.ac.uk](mailto:eprints@whiterose.ac.uk)  
<https://eprints.whiterose.ac.uk/>

## Screening For Obstructive Sleep Apnea At Home Based On Deep Learning Features Derived From Respiration Sounds

Romero, H. E.<sup>1</sup> · Ma, N.<sup>1</sup> · Hill, E. A.<sup>2</sup> · Brown, G. J.<sup>1</sup>

<sup>1</sup>Department of Computer Science, University of Sheffield, Sheffield, UNITED KINGDOM, <sup>2</sup>Sleep Research Unit, University of Edinburgh, Edinburgh, UNITED KINGDOM.

Sleep 43(Supplement\_1):a219–a220 27 May 2020

### *Abstract:*

**Introduction:** Analysis of sleep breathing sounds has been employed to screen obstructive sleep apnea (OSA). However, most current methods rely on specialized equipment (e.g., tracheal microphones), require additional physiological data (e.g., oxygen saturation), are rule-based, or are trained on data collected in-lab, making them less suitable for home use. In this study, deep learning methods were leveraged to explore the hypothesis that sleep audio recordings collected via smartphones can be used alone to screen for OSA by exploiting the temporal pattern of respiration sounds.

**Methods:** Adult participants with suspected sleep-disordered breathing of varying degrees of severity were recruited from the general population and from GP referrals to sleep clinic. Audio recordings were collected via smartphones during home sleep apnea testing (HSAT). HSAT data were scored by a registered polysomnographic technologist in accordance with current international guidelines (AASM V2.5, 2018) and used as reference. To exploit acoustic respiration temporal pattern, time interval histograms were computed for sequences of audio-words that were automatically learned from spectral features with a deep neural network. Means and standard deviations of the time intervals for each audio-word were employed by a Gaussian mixture model to classify 2-minute audio recording segments as either containing OSA events or not.

**Results:** Preliminary data from 4 valid nights' recordings obtained from 2 consented participants was analysed. 550 segments were used for training, with 180 segments used for evaluation. Audio recording demonstrated a sensitivity of 0.71 and specificity of 0.66 when compared with manually-scored HSAT.

**Conclusion:** Preliminary results suggest that an approach to OSA screening based on deep learning with inter-audio-word intervals to capture information about respiration temporal pattern may be a useful tool in diagnosis of OSA. Further model development is underway using data collected from up to 200 patients and full study data will be presented.

**Support:** The project is supported by an Innovate UK grant (project number 157358). HR is supported by a joint scholarship from Passion for Life Healthcare Ltd and University of Sheffield. LH acknowledges the financial support of NHS Research Scotland (NRS), through NHS Lothian.