

Airflow Estimation From Respiratory Sounds

by

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Acknowledgements come here...

ABSTRACT

Airflow Estimation From Respiratory Sounds

One page abstract will come here.

ÖZET

Solunum Seslerinden Soluk Akışı Kestirimi

Bir sayfa uzunluğunda özet gelecektir.

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LIST OF SYMBOLS

a_{ij}	Description of a_{ij}
\mathbf{A}	State transition matrix of a hidden Markov model
α	Blending parameter <i>or</i> scale
$\beta_t(i)$	Backward variable
Θ	Parameter set

LIST OF ACRONYMS/ABBREVIATIONS

2D	Two Dimensional
3D	Three Dimensional
AAM	Active Appearance Model
ASM	Active Shape Model

1. INTRODUCTION

Start with an introduction...

2. EXPERIMENTAL SETUP AND DATA

Start with an introduction...

3. AIRFLOW CURVE ESTIMATION

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3.1. Respiratory Sound Modelling

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4. AIRFLOW PHASE DETECTION

Start with an introduction...

4.1. Estimation of Periods

4.2. Estimation of Change Point Locations

4.3. Feature Extraction

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5. CONCLUSION

The conclusions of the thesis should come here.

REFERENCES

1. Doebelin, E. O., *Control System Principles and Design*, John Wiley & Sons, Inc., New York, NY, USA, 1985.
2. Schneider, J., *The Extrasolar Planets Encyclopaedia*, 2010, <http://exoplanet.eu/catalog.php>, May 2011.
3. Aran, O., I. Ari, A. Guvensan, H. Haberdar, Z. Kurt, I. Turkmen, A. Uyar and L. Akarun, “A Database of Non-Manual Signs in Turkish Sign Language”, *Signal Processing and Communications Applications, 2007. SIU 2007. IEEE 15th*, pp. 1–4, 2007.
4. Liu, W., *Development of Finite Element Procedures for Fluid-Structure Interaction*, Ph.D. Thesis, California Institute of Technology, 1981.
5. Hoogendoorn, M., J. Treur and P. Yolum, “A Labeled Graph Approach to Analyze Organizational Performance”, *Proceedings of the 2006 IEEE/WIC/ACM International Conference on Intelligent Agent Technology*, 2006.

APPENDIX A: APPLICATION

The appendices start here.