

P-01

The Shape of Chronic Obstructive Pulmonary Disease

Francisco Belchi-Guillamon¹, Mariam Pirashvili¹, Joy Conway², Michael Bennet³,
Ratko Djukanovic⁴, Jacek Brodzki¹

¹*School of Mathematics*, University of Southampton, ²*Health Sciences*, University of Southampton,
³Respiratory Biomedical Research Unit (BRU), Southampton General Hospital, ⁴Medicine, University of
Southampton

Quantitative features that can be obtained from medical imaging are far from creating a complete picture of Chronic Obstructive Pulmonary Disease (COPD). This makes spirometry tests still be the current most common diagnostic technique in COPD. In this work, we create a more complete picture of the disease by extracting from chest CT scans novel quantitative features that encode the precise structure of the airways inside the lungs. These features are computed using Persistent Homology, allow us to distinguish patients at different stages of COPD without the need for normalising by size and are related to airway deflection, cavity quantification and length of the bronchial tree.

Our CT measurements differ substantially to those used in current research, most of which consist of the absolute or relative volume of some region in the lungs. Additionally, the size independence contrasts with the case of lung function measurements such as FEV1%.