1. Motivation

- Pulmonary Embolism (PE): partial occlusion of pulmonary arteries due to a blood clot.
- Fifth most probable cause of death in Australia.
- Hard diagnosis.
- Current imaging techniques
  - CTPA: harmful radiation and nephrotoxic contrast agent.
  - Nuclear V/Q scan: time-consuming and invasive.
- Hence, the need for a reliable, portable and preferably non-invasive imaging technique for PE diagnosis

2. Electrical Impedance Tomography

- A functional imaging technique
- It is:
  - Portable and inexpensive
  - Non-invasive and radiation-free
  - High temporal and low spatial resolution

3. Project description

- Chest EIT contains both ventilation and perfusion signals.
- Since lung ventilation EIT is well-understood, we aim to:
  1. Investigate EIT for perfusion imaging
  2. Utilize impedance contrast agent to increase SNR
  3. Determine whether the technique is clinically relevant for PE diagnosis

4. Methodology

- In vivo experiments on an ovine model of human-adult size (83±7.7 kg)
- 32 channel EIT system, with 5mA injection current at 100 kHz, 10 fps
- Artificially occlude part of pulmonary arteries system to simulate PE with a balloon catheter
- Utilising intravenous saline 3% as contrast
- Image reconstruction with true ovine thorax shaped FEM → image of 64x64 pixels/frame

5. Results

- Change in perfusion imaging:
  - (IA) EIT lung perfusion image with no PE; (IB) contrast dilution at a pixel in the healthy right lung
  - (IIA) EIT lung perfusion image with artificial PE in the right lung; (IIB) contrast dilution at a pixel in the diseased lung.
  - Ventilation is unchanged in both cases.
- Quantification: Right to left lung (R2L) ratios of perfusion and ventilation

6. Conclusion

- EIT can potentially be the much needed answer for a continuous, portable and non-invasive imaging modality for PE diagnosis.
- Our results shows small to medium PE can be reliably imaged with perfusion EIT with the aid of saline 3% as contrast, without interruption in respiration
- Combination of ventilation and perfusion EIT can potentially be used of PE diagnosis