

Analysis of Oil and Gas Distributed Acoustic Sensor Data

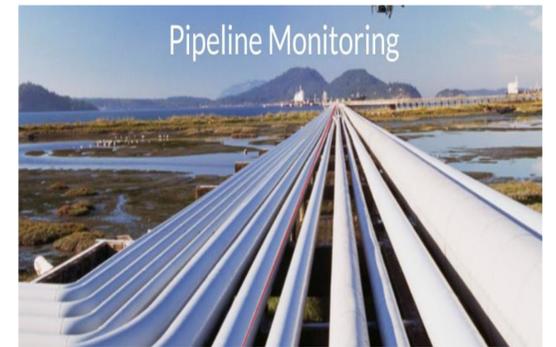
Nafiseh Vahabi, Eero Willman and Kai Wang
 Supervisor: Dr David R. Selviah
 Department of Electronic and Electrical Engineering, Photonics Research Group



What is Distributed Acoustic Sensor?

...is a sensor which uses optical fibre cable as a sensing element and records the acoustic signal along the path of the sensing fibre.

Recent developments enable optical fibre to be used to record distributed sounds as if from an array of microphones along the full length of a several kilometers long well. An optical fibre run down a well alongside a pipe carrying a fluid is attached to the pipe at several points. Then a laser pulse is sent down the optical fiber and it reflects back from either non-uniformities in the glass by Rayleigh scattering from every point along the fibre or by Brillouin scattering from acoustic waves. As the fluid mixture travels through the pipe its motion is very turbulent and it generate a noisy sound. This sound affects the light pulse so that when it is received at the surface again the sound can be recorded from every depth.



Data Challenges

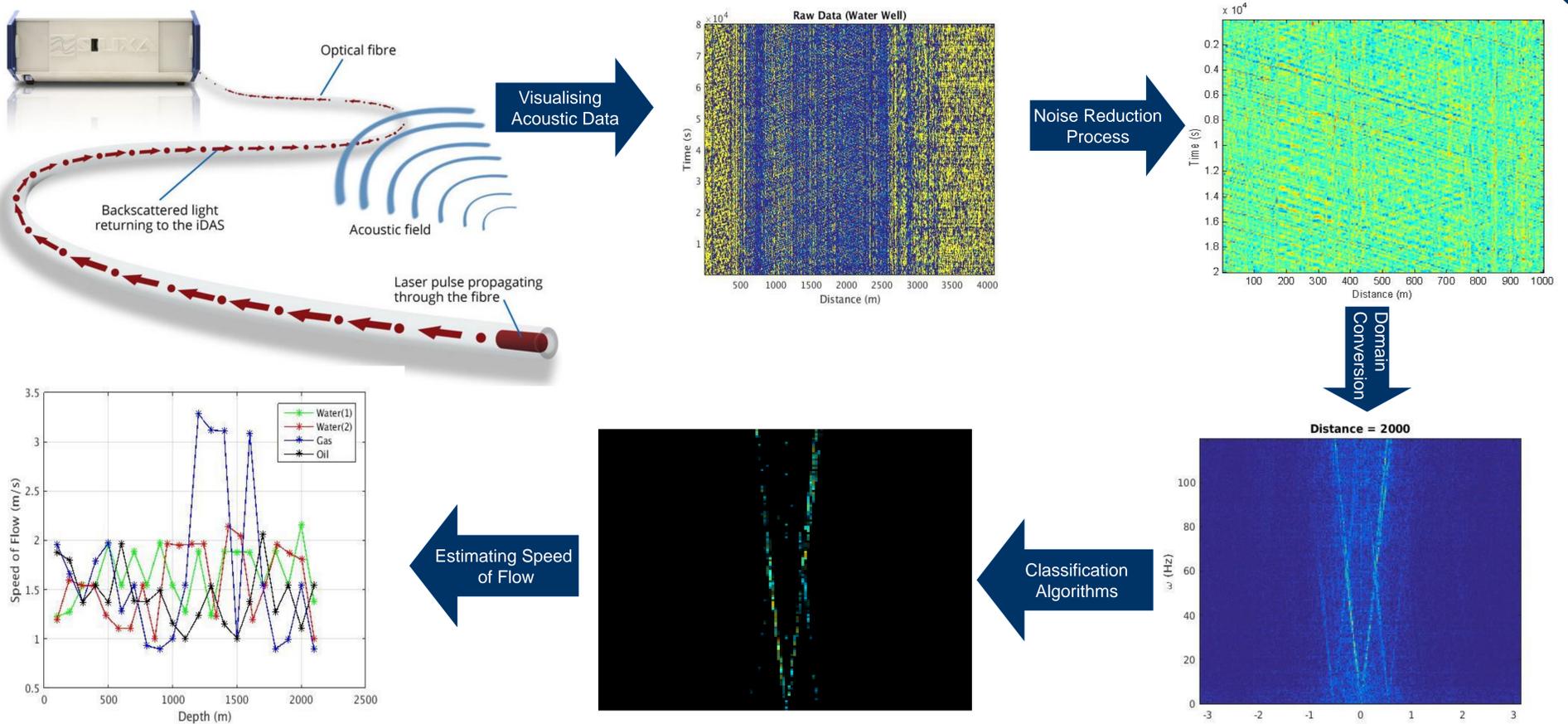
- Extremely noisy data
- Effect of pipe structure
- Low signal to noise ratio
- High volume data (48 Terabyte)
- Complex fluid composition (oil, gas, water)
- Effect of pipe material on sound propagation

Impact
of Our Model

Sound Saves Money

- High economic value
- Leak detection in pipes
- Maximising oil production
- Optimising oil quality production

Estimating Flow Speed From Acoustic Data



Conclusion

- Measuring speed of flow
- Monitoring fluid flow in the pipe
- Determines the direction of flow
- Applicable on oil, gas and water pipes
- Can be extended for leak detection in pipes

References

- [1] Xiao, J. J., Farhadiroushan, M., Clarke, A., Abdalmohsen, R. A., Alyan, E., Parker, T. R. and Milne, H. C., Intelligent Distributed Acoustic Sensing for In-well Monitoring, SPE Saudi Arabia Section Technical Symposium and Exhibition, Society of Petroleum Engineers, 2014.
- [2] Johannessen, K., Drakeley, B. K. and Farhadiroushan, M., Distributed Acoustic Sensing-a new way of listening to your well/reservoir, SPE Intelligent Energy International, Society of Petroleum Engineers, 2012.
- [3] Silixa's granted UK patents on the iDAS and flow monitoring methods. GB2482641 and GB2517100 both Farhadiroushan, Parker & Shatalin.

Acknowledgments

With thanks to my supervisor Dr Selviah for his advice, Silixa Ltd for providing the data and EPSRC for PhD studentship funding.
 Nafiseh.vahabi.14@ucl.ac.uk

