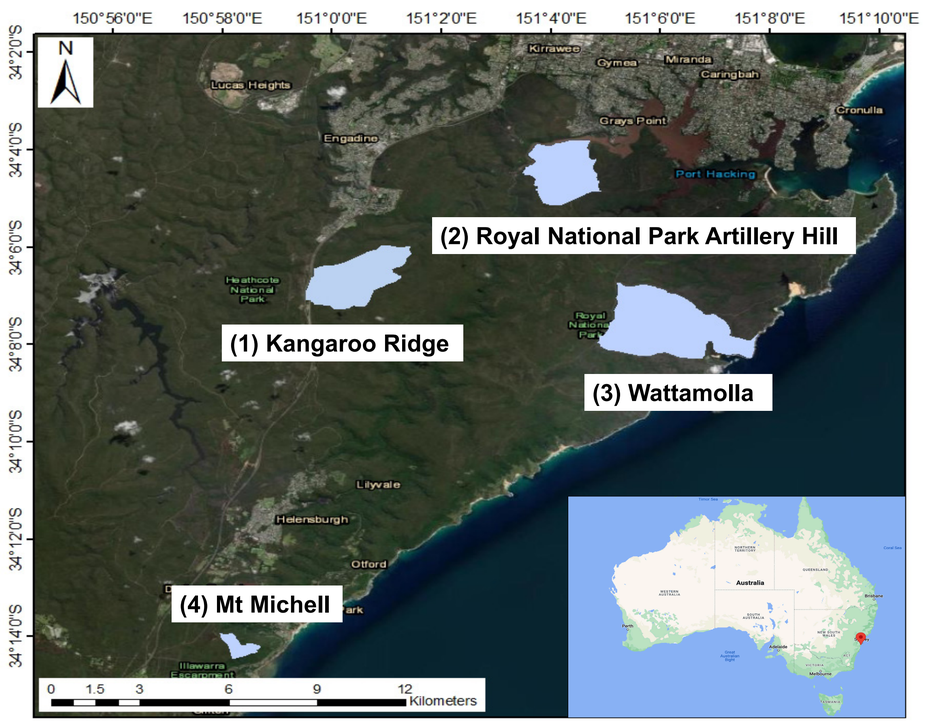
All-weather, near real-time monitoring of bushfire with satellite SAR

Linlin Ge[1], Chris Comer[2], Patrick Du[1], Ting Bai[1], Ziheng Sheng[1]
[1]University of New South Wales, Sydney (UNSW Sydney) [2]Nova Systems

Introduction

Most global bushfire monitoring products based on optical imagery have limitations in cloud-prone regions due to cloud coverage. All-weather Synthetic Aperture Radar (SAR) imagery can complement optical-based counterparts. Hence, the scope of this project has been to exploit the capability of interferometric coherence of high-resolution satellite SAR imagery applied in monitoring bushfire spread during day or night and any weather conditions.

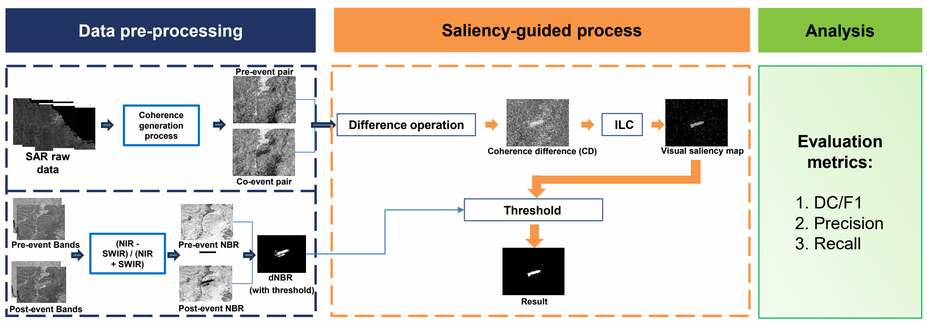


Bushfire locations of test sites in NSW, Australia (*The Shapefiles are provided by Geoscience Australia (GA)*)

Aims

The study aims to propose and evaluate saliency-guided methods by deeply exploiting the capability of interferometric coherence difference (CD) from SAR images for bushfire monitoring. To develop a practical product to detect bushfire and generate near-real time mapping results for the industry.

Methodology



Improved Luminance Contrast (ILC):

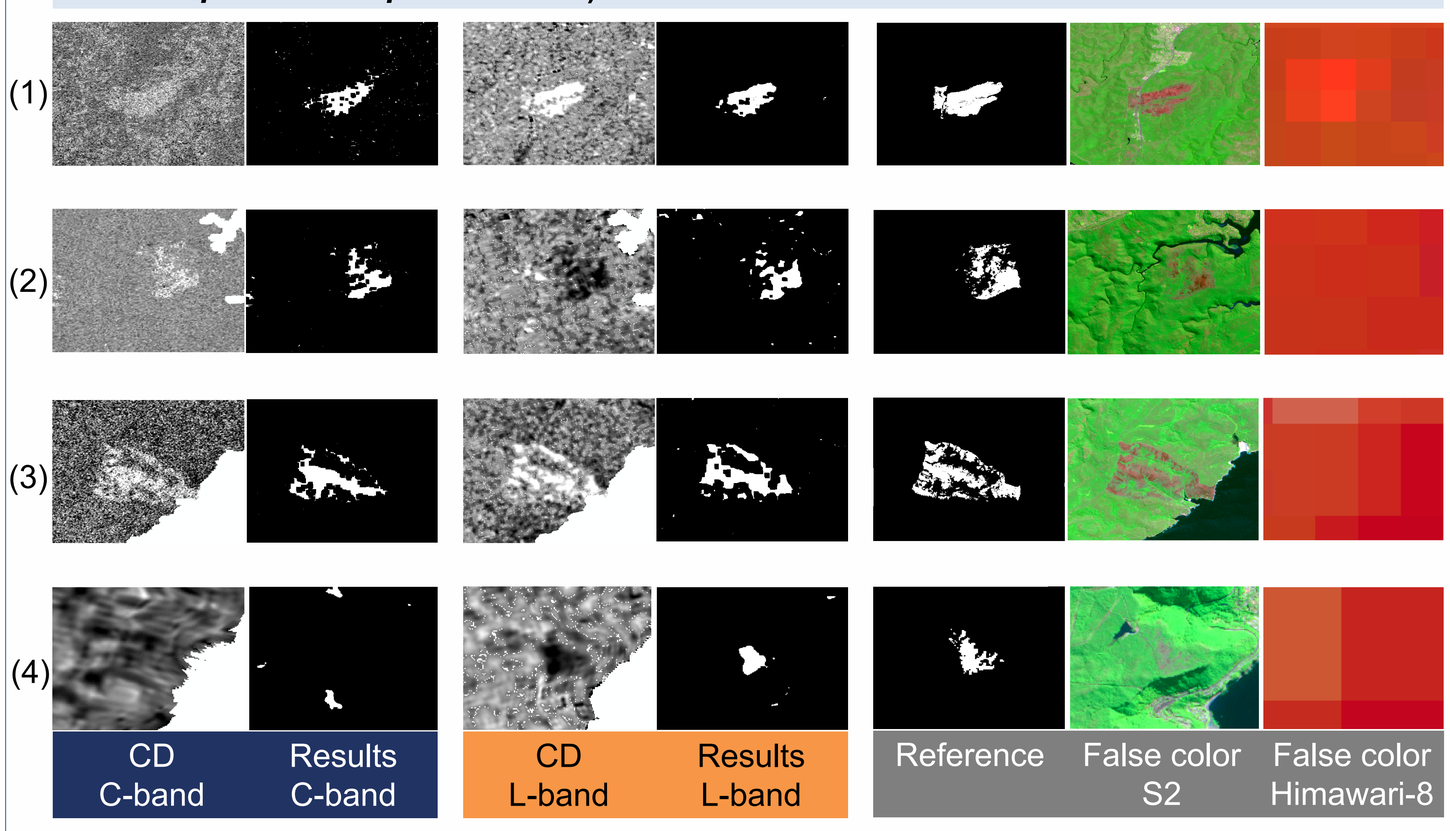
Firstly, employ *Multi-Scale Retinex (MSR)* algorithm for augmented coherence difference image;

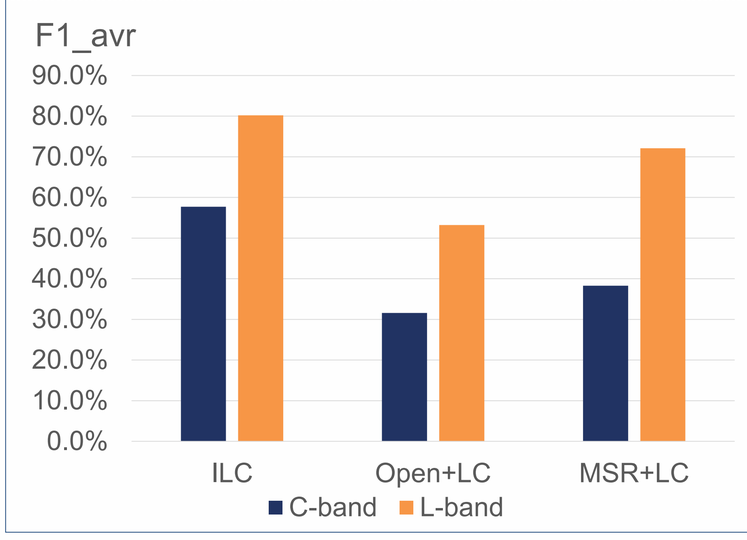
Connect the split burned pieces by *Morphologic Open (MO)*;

Finally, obtain the visual saliency map by *Luminance Contrast (LC)* saliency algorithm.

Results

C-band SAR vs **L-band SAR** vs **optical** (***L-band based results can be accurately verified with comparison to optical results***)





- L-band performs better than C-band
- MSR is more important than MO
- Without MO, the performance is slightly worse for L-band

Discussion

Interferometric coherence can be used for bushfire monitoring, providing a robust all-weather complement to current techniques based on optical remote sensing;

ILC algorithm is capable of highlighting burned scars images and suppressing noises in coherence difference;

L-band based results have stand out, demonstrating the immense potential of leveraging ALOS-2 images for bushfire monitoring and response.

References

Bai, T., Ge, L., Sepasgozar, S., Sheng, Z., Liu, C., Wu, Y., & Zhang, Q. (2023). An Improved Luminance Contrast Saliency Map for Burned Area Mapping Based on InSAR Coherence Difference Image, *In 2023 IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2023),* Pasadena, California.

Ge, L., Wang, Y., Zhang, Q., Du, Z., Liu, C., Dong, Y., ... & Ma, Z. (2021). Quantitative, Near Real-Time Mapping of Bushfires Through Integration of Optical and SAR Remote Sensing Techniques. *In 2021 IEEE International Geoscience and Remote Sensing Symposium (IGARSS),* pp. 455-458.

ting.bai@unsw.edu.au

Australian Government
Department of Industry, Science, Energy and Resources
AusIndustry Cooperative Research Centres Program