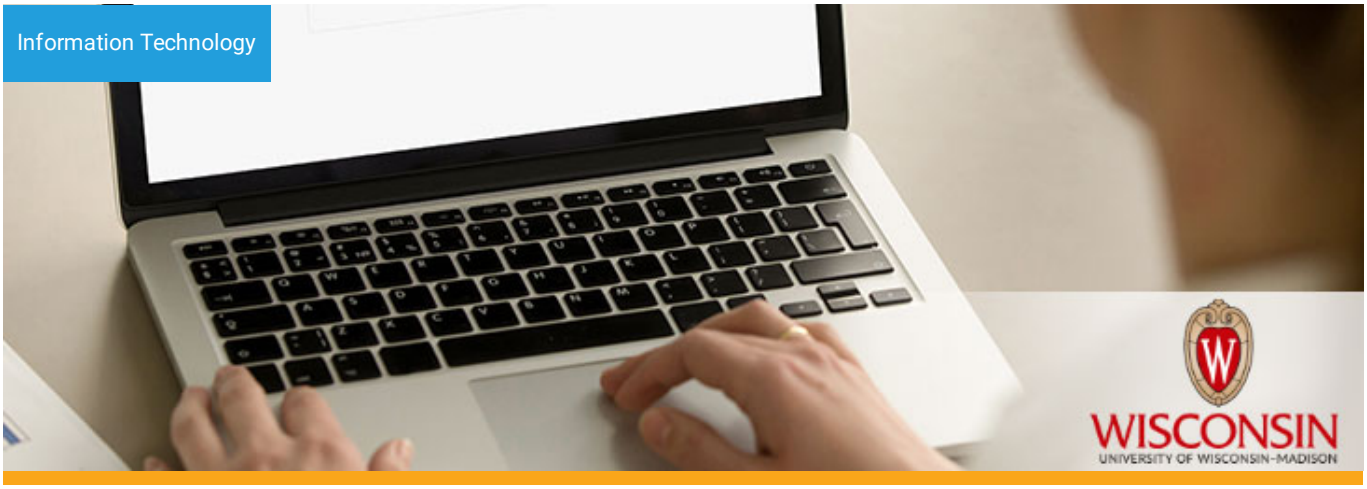
Information Technology



Algorithm for Estimating Parameters from Phase Data Without Unwrapping for Studying Earth's Surface

View U.S. Patent No. 7,446,705 in PDF format.

WARF: P07465US

Inventors: Kurt Feigl, Clifford Thurber

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing an improved method and device for determining the impact of a geophysical event on an area.

Overview

Synthetic aperture radar (SAR) is an active remote sensing technique used for measuring geophysical activity on the Earth's surface. It records microwaves transmitted by a sensor (usually aboard a satellite) and reflected by features on the Earth's surface (usually on land). The reflected signal contains information in the form of amplitude and phase data, and requires sophisticated post-processing.

A technique known as interferometric SAR (InSAR) measures the difference in phase between two images of the same area, which can be used to measure motion and deformation of the ground. In most applications, the interferogram must be "unwrapped" before it can be interpreted. The unwrapped interferogram may be used to monitor geophysical changes on the Earth's surface associated with earthquakes, volcanoes, landslides or glaciers, or with the withdrawal of oil, gas, water or minerals by extractive industries. Unwrapping requires considerable computational power and time, and may lead to significant mistakes in the unwrapped interferogram and thus in its intepretation.

The Invention

UW-Madison researchers have developed an algorithm for interpreting an interferogram without the need for unwrapping. To do so, the invention interprets the interferogram by estimating parameters in a quantitative model directly from the wrapped phase data. Alternative unwrapping algorithms have been developed, but these can provide inadequate results in areas where the phase data are imperfect, leading to errors in the unwrapped phase values. Likewise, these algorithms rarely, if ever, provide uncertainty estimates, limiting attempts to weight the data in statistical analysis. Implementation of the invention would reduce the time and resources necessary for advanced interpretation of InSAR data products, and would provide a more accurate result that includes an assessment of the uncertainties of the parameter estimates.

Applications

- InSAR for monitoring hazardous natural phenomena, e.g., landslides
- InSAR for monitoring subsidence due to extraction, e.g., oil, gas, water

Key Benefits

- Validated on real (noisy) data in a peer-reviewed publication
- Provides a more direct path to a quantitative interpretation than existing methods

- Provides a realistic assessment of uncertainty, unlike existing methods
- Potentially applicable to other phase data, e.g., pattern recognition in color images

Additional Information

For More Information About the Inventors

- Kurt Feigl

Publications

- Feigl K.L and Thurber C.H. 2009. A Method for Modelling Radar Interferograms without Phase Unwrapping: Application to the M 5 Fawnskin, California Earthquake of 1992 December 4. Geophys. J. Int. 176, 491-504.

Tech Fields

- Information Technology : Image processing

For current licensing status, please contact Michael Carey at mcarey@warf.org or 608-960-9867