A region growing algorithm for insar phase unwrapping

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Phase Unwrapping in Interferometric Synthetic Aperture Radar (InSAR)**

InSAR Technique

InSAR is a remote sensing technique that utilizes two or more Synthetic Aperture Radar (SAR) images to measure surface deformation. It can detect millimeters-to-centimeters scale displacements in the Earth's surface.

Phase Unwrapping

During InSAR processing, an interferogram is generated by combining the two SAR images. The interferogram contains phase information representing the surface deformation. However, the phase values are wrapped within the range -? to ?, making it difficult to interpret the actual displacement values. The process of recovering the continuous phase values from the wrapped phase is known as phase unwrapping.

Region Growing Algorithm

Region growing is an image segmentation algorithm used in phase unwrapping. It iteratively expands a growing region by merging neighboring pixels with similar phase values. The concept of the growing region is to identify and connect pixels that belong to the same continuous phase surface.

Region-Based Algorithm

Region-based phase unwrapping methods rely on the assumption that the phase varies smoothly within small regions. They divide the interferogram into smaller regions and unwrap the phase within each region independently.

Phase Unwrapping Method

The equation for phase unwrap is:

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?(x, y) = ?_w(x, y) + 2?n(x, y)
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where:

- ?(x, y) is the unwrapped phase
- ?_w(x, y) is the wrapped phase
- n(x, y) is the integer number of 2? wraps

Phase Folding Method

The phase folding method involves subtracting 2? from the wrapped phase until it falls within the unwrapping range (-?/2, ?/2). This allows for easier unwrapping of the folded phase.

Unwrap Method

The unwrap method removes the 2? jumps from the folded phase by identifying and connecting pixels with the same phase value.

Region Filling Algorithm

Region filling algorithms are used for phase unwrapping in areas where the phase is discontinuous or ambiguous. They iteratively fill in missing or noisy phase values based on the surrounding information.

Region Growing Classification

Region growing classification is a method of segmenting the interferogram into regions based on their phase values. This classification helps identify regions with consistent phase behavior and facilitates the application of region-based phase unwrapping algorithms.

Region of Fastest Growth

The region of fastest growth in a region growing algorithm refers to the pixel or group of pixels where the algorithm expands most rapidly. It indicates the presence of a strong phase gradient or a higher likelihood of unwrapping success.

Growth Rate of an Algorithm

The growth rate of an algorithm refers to the rate at which it expands or adds new elements to its growing region. A faster growth rate can lead to more efficient and rapid phase unwrapping.

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