Chapter 16


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ABSTRACT

Synthetic Aperture Radar (SAR) are imaging Radar, it uses electromagnetic radiation to illuminate the scanned surface and produce high resolution images in all-weather condition, day and night. Interference of signals causes noise and degrades the quality of the image, it causes serious difficulty in analyzing the images. Speckle is multiplicative noise that inherently exist in SAR images. Artificial Neural Network (ANN) have the capability of learning and is gaining popularity in SAR image processing. Multi-Layer Perceptron (MLP) is a feed forward artificial neural network model that consists of an input layer, several hidden layers, and an output layer. We have simulated MLP with two hidden layer in Matlab. Speckle noises were added to the target SAR image and applied MLP for speckle noise reduction. It is found that speckle noise in SAR images can be reduced by using MLP. We have considered Log-sigmoid, Tan-Sigmoid and Linear Transfer Function for the hidden layers. The MLP network are trained using Gradient descent with momentum back propagation, Resilient back propagation and Levenberg-Marquardt back propagation and comparatively evaluated the performance.

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**1. INTRODUCTION**

Radar system was developed during World War II to track aircrafts and ships. Radar system measures distance to the target by precisely calculating the time delay between sent and received signal. Doppler shifts were used to measure target speed. In 1951, Carl Wiley from Goodyear Aerospace found that radar can be used to create images from target and earth surface. In 1970s applications of Remote Sensing was open for civilian use (Chan and Koo, 2008). It drew the attention of researchers and application grew rapidly.

SAR produces high resolution two dimensional images of mapped areas (Tomiyasu, 1978). It is mounted on moving platform such as aircraft or spacecraft. A SAR works by illuminating the scanned surface with a beam of coherent electromagnetic radiation in a side-looking direction, the returned echo form the illuminated are collected by SAR receiver and processed to reconstruct the image of the surface. SAR geometry is shown in Figure 1(Dastgir, 2007). The SAR platform flies along the azimuth direction at constant velocity. It is not feasible for a spacecraft to carry a very large antenna, which is required for producing high resolution image of the earth surface. SAR uses the forward motion of platform to

![Figure 1. SAR Geometry](image-url)
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