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Abstract

This paper presents a microwave dual frequency correction algorithm to measure the water content of the oil-water two-phase flows, which can eliminate the influence of conductivity and obtain the water content. Subsequently, based on the advantages of dual-frequency this paper proposes a deep neural network model to predict complex nonlinear relationship between the mixture permittivity and water content. In order to avoid falling into a local optimal solution, the adaptive moment estimation algorithm is used to replace the gradient descent method. The experimental results are applied to estimate the performance of the discussed deep neural network algorithm.
Keywords: oil-water two-phase flow measurement, microwave, deep neural network

1. Introduction

Oil–water two-phase flows are commonly found in the production processes of the petroleum industry. Water-to-liquid ratio (WLR) is an important parameter of the mixture and widely encountered practice in all aspects of oil and gas industry. There are many methods to measure the water content. Traditional method is to select part of the sample to check the water content value, but this method is limited to sampled data and cannot be widely used. Density measurement can be used to calculate water content, however the gamma-ray attenuation is with high cost [1]. Electrical capacitance tomography method is a mature method [2-5], but this is limited to regular calibration and the range of the oil-continuous. Short wave absorption method can measure instantaneous water content, but this is difficult to debug and is not suitable for situations where the medium contains lots of gas [6]. Microwave measurement technology has the advantages of accurate measurement, easy installation, and low external influence over other technologies, therefore this method is discussed in the paper.