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Crude oil price analysis and forecasting based on variational mode decomposition and independent component analysis

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Abstract

As one of the most vital energy resources in the world, crude oil plays a significant role in international economic market. The fluctuation of crude oil price has attracted academic and commercial attention. There exist many methods in forecasting the trend of crude oil price. However, traditional models failed in predicting accurately. Based on this, a hybrid method will be proposed in this paper, which combines variational mode decomposition (VMD), independent component analysis (ICA) and autoregressive integrated moving average (ARIMA), called VMD-ICA-ARIMA. The purpose of this study is to analyze the influence factors of crude oil price and predict the future crude oil price. Major steps can be concluded as follows: Firstly, applying the VMD model on the original signal (crude oil price), the modes function can be decomposed adaptively. Secondly, independent components are separated by the ICA, and how the independent components affect the crude oil price is analyzed. Finally, forecasting the price of crude oil price by the ARIMA model, the forecasting trend demonstrates that crude oil price declines periodically. Comparing with benchmark ARIMA and EEMD-ICA-ARIMA, VMD-ICA-ARIMA can forecast the crude oil price more accurately.

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