China is the second worst among 180 countries included in the index this year.

Environmental monitoring and early warning is the basic function of environmental protection work, not only in relation to scientific decision-making, but also long-term development.

To achieve this, more than 2700 monitoring stations have been established with more than 268,000 sets of monitoring instruments, and approximately 60,000 monitoring personnel.

The research can be divided into air quality assessment and air pollutants forecasting

Although traditional air quality assessment used a simple digital indicator as a dividing line, with each side divided into different levels, the classification standard is not objective. The evaluation of air quality, which is aimed at determining "the degree of pollution,” is a fuzzy concept, and it is difficult to find clear boundaries; thus, the evaluation classification standard of pollution levels should also be fuzzy. Therefore, fuzzy logic is a suitable tool for air quality assessment (Zadeh, 1965; Hájek and Olej, 2009; Abdullah and Khalid, 2012; Akkaya et al., 2015), and many fuzzy-based air quality indices have been proposed (Mohammad et al., 2011; Miguel and Ignacio, 2016).

The forecasting methods can be divided into two major categories: deterministic models and statistical models

Deterministic: - chemical transport model (CTM).

Statistical: - autoregressive integrated moving average (ARIMA) model

Multi-linear regression (MLR) model

Artificial neural network (ANN) model

To overcome this limitation, nonlinear models, such as the support vector machine (SVM) (Osowski and Garanty, 2007; Suarez Sanchez et al., 2011; Lin et al., 2011), the radial basis function (RBF) (Paschalidou et al., 2011), and fuzzy logic (FL) (Alhanafy et al., 2010), have been adopted to forecast air pollution

In addition, hybrid models have also been proposed to improve the forecasting accuracy of air pollutant concentration. Qin (2014) (Qin et al., 2014), proposed a hybrid model combing ensemble empirical mode decomposition (EEMD), cuckoo search (CS), and back-propagation (BP) artificial neural networks for forecasting PM concentrations.

The proposed optimization algorithm, MCSDE, combines CS and DE. It can provide better initial weights and thresholds to ENN, and improve the forecasting capability. Tests show that the model can avoid getting trapped into local optima, and the global searching capability is enhanced.

To estimate the forecasting performance, the Diebold-Mariano test, bias-variance framework, and three error criteria are adopted, including mean absolute error (MAE), mean absolute percentage error (MAPE), and mean square error (MSE).

**Methodology:**

**Different algorithms explained**

Fuzzy comprehensive evaluation

Complementary ensemble empirical mode decomposition (CEEMD)

Elman neural network (ENN)

Modified cuckoo search and differential evolution algorithm (MCSDE)

Cuckoo search (CS)

Differential evolution algorithm (DE)

Hybrid optimization algorithm

**Results:**

