I perform comprehensive comparison of the standard realised volatility estimators including a novel wavelet time-frequency estimator (Barunik and Vacha 2012) on wide variety of assets: crude oil, gold and S&P 500. The wavelet estimator allows to decompose the realised volatility into several investment horizons which is hypothesised in the literature to bring more information about the volatility time series. Moreover, I propose artificial neural networks (ANN) as a tool for forecasting of the realised volatility. Multi-layer perceptron and recursive neural networks typologies are used in the estimation. I forecast cumulative realised volatility on 1 day, 5 days, 10 days and 20 days ahead horizons. The forecasts from neural networks are benchmarked to a standard autoregressive fractionally integrated moving averages (ARFIMA) model and a mundane model. I confirm favourable features of the novel wavelet realised volatility estimator on crude oil and gold, and reject them in case of S&P 500. Possible explanation is an absence of jumps in this asset and hence over-adjustment of data for jumps by the estimator. In forecasting, the ANN models outperform the ARFIMA in terms of information content about dynamic structure of the time series.