A Meta-cognitive Quaternion Valued Neural Network (Mc-QVNN) learning algorithm and its forecasting applications is proposed in this paper. The Mc-QVNN has two parts, the cognitive part that contains the QVNN and a meta-cognitive part, which self-regulates the learning algorithm. At each epoch, when the Mc-QVNN receives a new sample, the meta-cognitive part makes a decision about the manner, the time and the need to learn this sample or not. In this case, the algorithm deletes the unneeded samples and keeps just the necessary ones for learning. The meta-cognitive component makes the decision according to the quaternion magnitude and phases. Three forecasting problems, which are Mackey–Glass time series, Lorenz attractor and the real home's power in the city of Honolulu in Hawaii, USA, are taken to test the performance of the proposed algorithm. Comparison with other existing methods shows that the Mc-QVNN is promising for forecasting chaotic systems