Passive microwave radiometers onboard satellites rely on the received upwelling radiation to retrieve precipitation, which is a mixed signal from the surface, atmosphere and precipitation hydrometeors. Liquid precipitation droplets increase the upwelling radiation from the surface at lower frequencies, while ice particles cause a decrease in upwelling radiation at higher frequencies. The task of the retrieval algorithm is to identify the precipitation phase and to isolate the signal of precipitation from that of the surface. This study develops a machine learning method to retrieve rainfall and snowfall rates based on observations from the Microwave Hydrometer Sounder and Microwave Temperature Sounder onboard FY-3E. Self-organized mapping (SOM) is selected to classify the precipitation and underlying surface types, and an artificial neural network (ANN) is subsequently used to relate the brightness temperature to the precipitation rate for the clusters derived from the SOM. The half-hour product of the Integrated Multi-Satellite Retrieval for Global Precipitation Measurement (IMERG) is used to train the ANN. To address the issue that number of heavy precipitation samples are not enough for training, the simulation of radiative transfer for TOVS is used as a supplement to heavy rain samples. The SOM-ANN algorithm outperforms the IMERG and Goddard profiling algorithm (GPROF) retrieval products in both rainfall and snowfall retrieval. Compared with the hourly observations at ~4,400 stations during a 2-year period, the root mean square errors of SOM-ANN proposed here are 1.06 and 0.34 mm/hr for the rainfall and snowfall rates, which are better than those of IMERG (1.23 and 0.42 mm/hr) and GPROF (1.22 and 0.44 mm/hr).