We propose a novel early warning system for detecting financial market crashes that utilizes the information extracted from the shape of financial market movement. Our system incorporates topological data analysis (TDA), a new set of data analytics techniques specialised in profiling the shape of data, into a more traditional machine learning framework. Incorporating TDA leads to substantial improvements in timely detecting the onset of a sharp market decline. Our framework is both able to generate new features and also unlock more value from existing factors. Our results illustrate the importance of understanding the shape of financial market data and suggest that incorporating TDA into a machine learning framework could be beneficial in a number of financial market settings