AI can now predict space weather with unprecedented accuracy

NYU Abu Dhabi scientists develop new AI system that can predict solar winds four days in advance, helping protect satellites and technology infrastructure from dangerous space weather.

Researchers have developed an AI system that can predict solar wind conditions up to four days before they reach Earth, with accuracy far surpassing current methods.

By training the model on ultraviolet images of the Sun provided by NASA's Solar Dynamics Observatory (SDO), the team discovered patterns of change that could predict potentially dangerous space weather.

A team of scientists at NYU Abu Dhabi (NYUAD) has built an AI system that can predict solar wind speeds up to four days in advance. The work, published in *The Astrophysical Journal Supplement Series* , shows a level of accuracy that surpasses traditional forecasting techniques.

Why is solar wind forecasting important?

Solar wind is a continuous stream of charged particles emitted from the Sun. When this flow intensifies, it can create space weather phenomena that disrupt Earth's atmosphere, throw satellites off course, damage electronics in orbit, and even affect ground power systems. In 2022, a powerful solar wind event caused SpaceX to lose 40 Starlink satellites—a clear demonstration of the importance of early warning.

Led by researcher Dattaraj Dhuri and Center for Space Science (CASS) co-investigator Shravan Hanasoge, the NYUAD team developed the AI ??system by combining high-resolution ultraviolet images from SDO with historical data on the solar wind.

Unlike popular linguistic AI models, the system analyzes detailed images of the Sun to identify visual cues related to solar wind fluctuations. This approach improves accuracy by 45% compared to currently operating forecasting models and by 20% compared to previous AI methods.

Strengthening the protection of satellites and technology infrastructure

This is a major step forward in protecting satellites, navigation systems and the critical electrical infrastructure on which modern life depends, said Mr. Dhuri. Combining advanced AI with solar observations could provide early warning, reducing the risk of damage on the ground and in space.

The achievement underscores the growing role of AI in solving one of the most difficult problems in space science: predicting the behavior of solar wind. With increased confidence, scientists and engineers can be more proactive in preparing for upcoming space weather events, thereby better protecting critical systems and infrastructure around the world.