# Enhancement of dynamic wireless communication system speed and performance using continuous learning

**An approach that enables data-driven methods to continuously learn and optimize resource allocation strategies in dynamic environments of wireless communications.**

**IP Status:** Provisional Patent Application Filed

## Applications

- Wireless Communication Methods: WiFi, Mobile, and Satellite communications, Global Positioning System.
- Signal Processing

## Key Benefits & Differentiators

- **Improved Performance:** Dividing temporal dynamic data into stationary episodes enables continuous learning from the most relevant episodes across all times, making the model predictions more accurate.
- **Improved Speed:** The allocation of working memory for storing samples leads to better memory management which improves speed.
- **Reduced Cost:** Data from all time are learned by the model without additional memory installations, which reduces cost.

## Improving speed and performance of dynamic tasks in wireless communication systems using data-driven methods

Providing accurate predictions using data-driven models for wireless communication systems in a dynamic environment is extremely challenging. The key reasons behind the challenges are (a) the inability to learn from data across all times without over-writing information from earlier time-steps, and (b) additional memory requirement to incorporate information from earlier times. In existing systems, whenever the data distribution changes, the actual system performance significantly drops because the models are learned based on outdated information.

Prof. Mingyi Hong at the University of Minnesota has developed a method that addresses the above challenges by using continuous learning and allocation of working memory for storing samples. To do this, dynamic temporal data is divided into episodes consisting of stationary data and retaining information from the most significant episodes. This makes the model predictions accurate since the model retains information from not only the most recent times (as in other models), but also from all previous significant times. Division of time into episodes of stationary data enables the model to incrementally learn from significant episodes without overwriting prior information. This is made possible by allocating working memory (based on available system memory size) for storing samples.
The proposed method would be beneficial for all wireless communication systems, for tasks

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**Category**
Software & IT/Algorithms
Software & IT/Artificial Intelligence
Software & IT/Communications & Networking
Software & IT/Image & Signal Processing

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such as resource allocation, channel estimation, channel decoding, etc by improving the speed and accuracy of the model performance.

### Phase of Development

**TRL: 3-4**

Working prototype. The model has been demonstrated to provide accurate predictions for two well-known cases, namely, beamforming and power control.

### Desired Partnerships

This technology is now available for:

- License
- Sponsored research
- Co-development

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### Researchers

- **Mingyi Hong, Ph.D.**, Associate Professor, Electrical and Computer Engineering

### References

1. Sun, Haoran, Wenqiang Pu, Xiao Fu, Tsung-Hui Chang, and Mingyi Hong , https://arxiv.org/abs/2105.01696