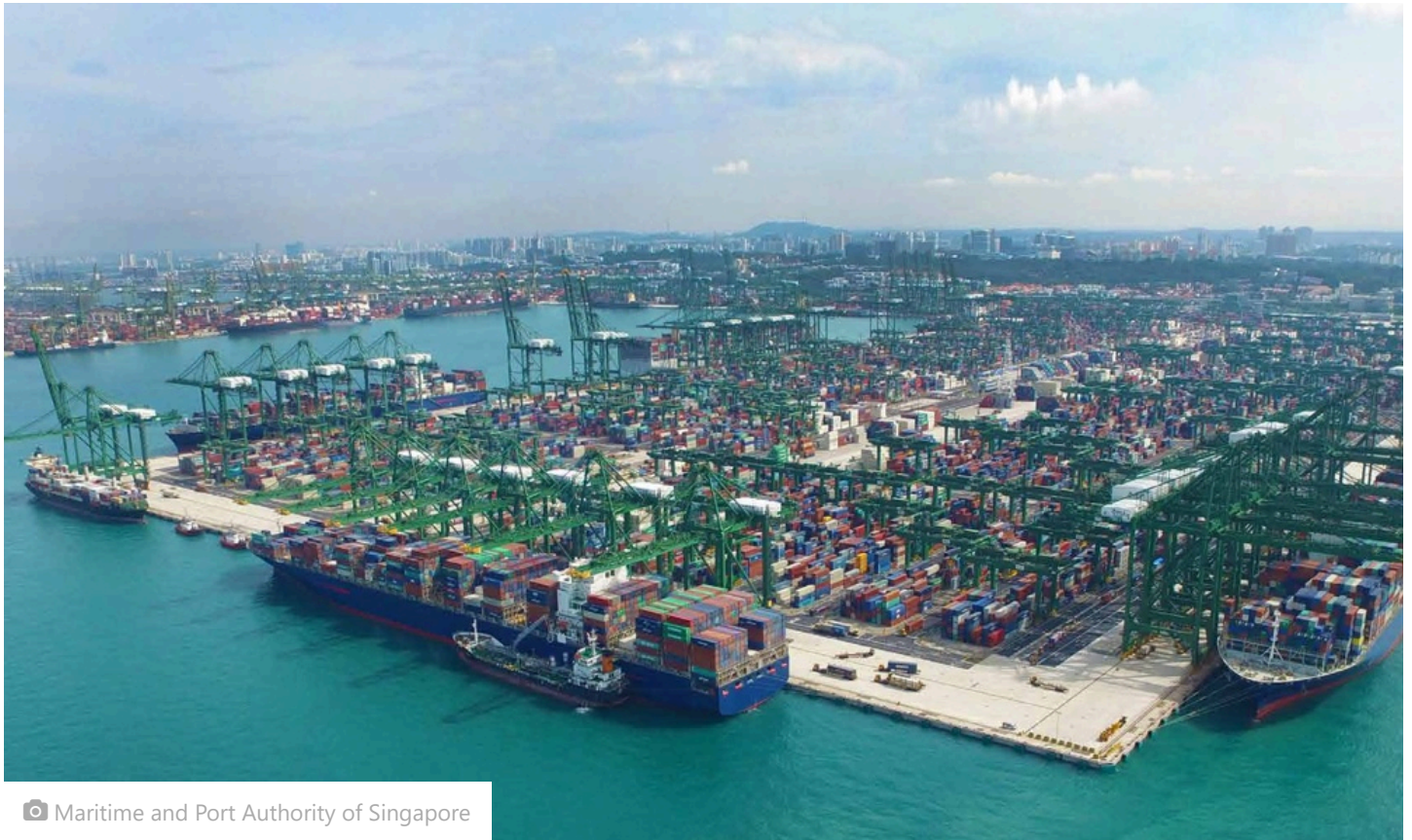




Maritime and Port Authority of Singapore

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Singapore researchers develop AI that can rewrite port planning algorithms

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Researchers at Singapore's Nanyang Technological University (NTU) have developed an artificial intelligence system capable of designing complex port planning algorithms, potentially transforming how terminals respond to changing operational conditions.

The technology, known as LACE (Large Language Model-driven Algorithm Construction via Complementary Evolution), uses large language models to generate and

refine algorithms for tasks including berth allocation, tugboat scheduling and vessel routing.

Unlike conventional optimisation systems, which can require months of specialist programming when operating conditions change, LACE allows users to describe new requirements and constraints without rebuilding the underlying algorithms from scratch.

"Using LLMs automates much of the process. When conditions change, you can revise the inputs instead of rebuilding the model and developing a new solution from scratch," said NTU research fellow Dr Huatian Gong.

Working with assistant professor Yan Ran from NTU's School of Civil and Environmental Engineering, Gong has developed a framework that divides complex optimisation problems into smaller components before generating and testing multiple potential solutions.

The results, published in Nature Machine Intelligence, are promising. LACE successfully generates workable algorithms for four previously unseen port-related optimisation problems, including vessel berth assignments and tugboat routing under varying operating conditions.

Five competing AI-based approaches fail to produce feasible solutions for any of the four problems. Across another 36 established optimisation benchmarks, LACE also outperforms existing AI-based methods.

According to NTU, the system generally produces solutions in around an hour, with language model and API costs below \$10.

"The AI era gives us the opportunity to democratise large-scale scheduling tasks," Yan said, arguing that users without extensive programming expertise could eventually develop sophisticated planning systems using natural language.

The researchers have released their code publicly on GitHub.

The technology remains at the research stage, but could eventually help ports adapt more quickly to berth closures, tugboat shortages, environmental restrictions and unexpected disruptions.

Applications beyond maritime include airports, railways, manufacturing and hospital scheduling.

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