

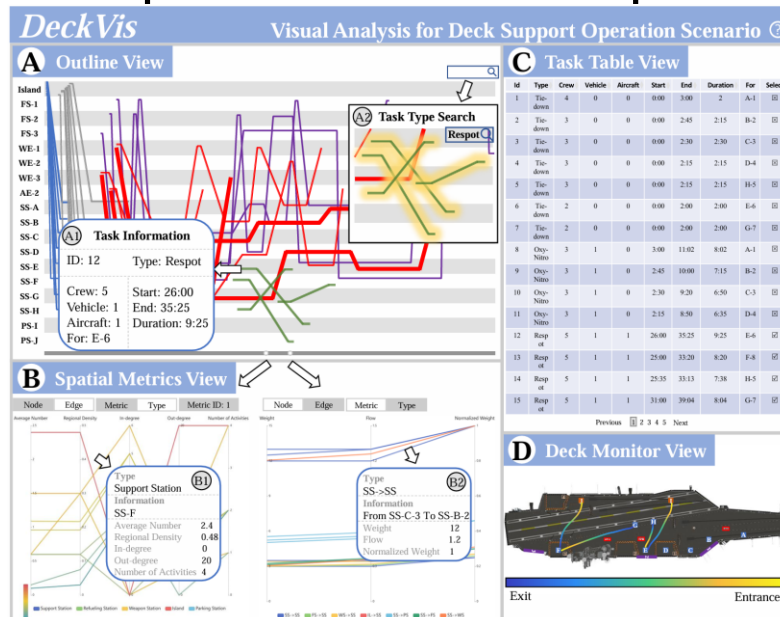
# DeckVis: Visual Analysis of Carrier-based Aircraft Deck Support Operation Scenarios

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Frontiers of Computer Science, DOI: [10.1007/s11704-025-50967-z](https://doi.org/10.1007/s11704-025-50967-z)

# Problems & Ideas







- Problems of Current Deck Operation Analysis:
  - Existing approaches mainly focus on recognizing tasks but fail to provide an intuitive, multi-scale analysis of the spatiotemporal coupling and dynamic evolution among multiple tasks.
  - They also usually require large amounts of high-quality annotated data, which limits their scalability and applicability in real-world scenarios.
- Ideas: We propose an unsupervised recognition method and design *DeckVis*, a visual analysis system that enables multi-scale exploration of deck operation scenarios.



The user interface of *DeckVis* comprises four views. (A) The *outline view* shows the spatiotemporal distribution of tasks; (B) The *spatial metrics view* provides detailed spatial utilization metrics; (C) The *task table view* lists tasks in the scenario and allows users to select; (D) The *deck monitor view* visualizes the trajectories of selected tasks, aiding intuitive analysis.

# Main Contributions

- Contributions:
  - A feature-enhanced deep clustering method that jointly encodes, learns, and refines spatiotemporal trajectory features for task recognition;
  - A multi-scale visualization system (*DeckVis*) integrating four coordinated views, including outline, spatial metrics, task table, and deck monitor;
  - Enhanced user understanding and analysis efficiency in complex multi-task deck operations through intuitive visual interaction.

No.	Question	Avg.	Score Distribution
Q1	The system provides comprehensive information on carrier-based aircraft support operation scenarios.	4.50	
Q2	The system ensures clear linkage between different views with a well-structured organization of multi-scale information.	4.38	
Q3	The <i>outline view</i> effectively conveys the spatiotemporal distribution of tasks in an intuitive manner.	4.75	
Q4	The <i>spatial metrics view</i> provides robust analytical support for evaluating spatial utilization in support operation scenarios.	4.50	
Q5	The <i>task table view</i> delivers detailed task-related information along with interactive functionalities to enhance user engagement.	4.75	
Q6	The <i>deck monitor view</i> intuitively presents task trajectories, facilitating the validation and refinement of analytical results.	4.25	

Results of the user questionnaire assessing the usability and analytical effectiveness of *DeckVis*. High average scores across all six items demonstrate the system's clarity, interactivity, and strong support for task analysis.