15th Conference on

DATA ANALYSIS METHODS
for Software Systems

November 28–30, 2024

Druskininkai, Lithuania, Hotel "Europa Royale"
https://www.mii.lt/DAMSS

Co-Chairmen:

Prof. **Gintautas Dzemyda** (Vilnius University, Lithuanian Academy of Sciences)
Dr. **Saulius Maskeliūnas** (Lithuanian Computer Society)

Programme Committee:

Dr. **Jolita Bernatavičienė** (Lithuania)
Prof. **Juris Borzovs** (Latvia)
Prof. **Janis Grundspenkis** (Latvia)
Prof. **Janusz Kacprzyk** (Poland)
Prof. **Ignacy Kaliszewski** (Poland)
Prof. **Bożena Kostek** (Poland)
Prof. **Tomas Krilavičius** (Lithuania)
Prof. **Olga Kurasova** (Lithuania)
Assoc. Prof. **Tatiana Tchemisova** (Portugal)
Assoc. Prof. **Gintautas Tamulevičius** (Lithuania)
Prof. **Julius Žilinskas** (Lithuania)

Organizing Committee:

Dr. **Jolita Bernatavičienė**
Prof. **Olga Kurasova**
Assoc. Prof. **Viktor Medvedev**
Laima Paliulionienė
Assoc. Prof. **Martynas Sabaliauskas**
Prof. **Povilas Treigys**

Contacts:

Dr. Jolita Bernatavičienė
jolita.bernataviciene@mif.vu.lt
Tel. (+370 5) 2109 315
Prof. Olga Kurasova
olga.kurasova@mif.vu.lt

A Complex Network Approach to Marine Traffic Interaction Modeling: Feature Extraction for Real-Time Traffic Awareness

Julius Venskus[1], Robertas Jurkus[2], Povilas Treigys[1]

[1] Vilnius University
[2] Klaipeda University

julius.venskus@mif.vu.lt

Marine traffic interaction modelling is critical for improving situational awareness and enhancing safety in maritime operations. This paper presents an approach that leverages complex network theory and feature extraction techniques to model and analyze marine vessel interactions in real-time. Using Automatic Identification System (AIS) data, we construct a dynamic maritime network where nodes represent vessels, and edges capture interaction factors such as proximity, speed and heading correlation, and route similarity. Key network features, including degree centrality, clustering coefficient, and betweenness centrality, are extracted to characterize vessel interactions, offering deeper insights into patterns such as congestion, cooperative navigation, and risk-prone behaviours. Through the application of clustering and network analysis algorithms, we identify distinct interaction types and anomalous activities, enabling real-time predictions of traffic patterns and potential risks. The framework is validated using historical AIS data and maritime incident reports, demonstrating its effectiveness in enhancing real-time traffic awareness for vessel traffic service (VTS) operators and autonomous ship systems. This study offers a solution for modelling marine traffic dynamics and improving decision-making and operational efficiency in increasingly congested and complex maritime environments. This research contributes to the development of advanced tools for real-time maritime traffic management, providing actionable insights that enhance navigational safety and optimize marine operations.