# Paper Summary

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Title: Design of Information and Warfare Analytics using MapReduce and Machine Learning

Authors: Pallaw Kumar Mishra

DOI: n/a

Year: 2017

Publication Type: Conference Paper

Discipline/Domain: Defense Informatics / Military Data Science

Subdomain/Topic: Warfare analytics, big data, actionable intelligence, MapReduce, social network analys

Eligibility: Eligible

Overall Relevance Score: 90

Operationalization Score: 88

Contains Definition of Actionability: Yes (implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Partial

Contains Interpretability: Partial

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + System Design

Study Context: Development of an integrated information and warfare analytics system for military decisio

Geographic/Institutional Context: India / Defence Research and Development Organisation (DRDO)

Target Users/Stakeholders: Military decision-makers, defense analysts, cyber security teams, intelligence

Primary Contribution Type: Conceptual framework and system design proposal

CL: Yes

CR: Yes

FE: Yes

TI: Partial

EX: Partial

GA: Yes

Reason if Not Eligible: n/a

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Design of Information and Warfare Analytics using MapReduce and Machine Learning

**Authors:**

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**Discipline/Domain:**

Defense Informatics / Military Data Science

**Subdomain/Topic:**

Warfare analytics, big data, actionable intelligence, MapReduce, social network analysis

**Contextual Background:**

The paper addresses the growing need for real-time, data-driven decision support in modern warfare, lev

**Geographic/Institutional Context:**

India / Defence Research and Development Organisation (DRDO)

**Target Users/Stakeholders:**

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**Primary Methodology:**

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## General Summary of the Paper

The paper proposes a comprehensive “Information and Warfare Analytics System” to provide meaningful

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## Eligibility

Eligible for inclusion: **Yes**

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## How Actionability is Understood

The paper frames actionability as the ability of the system to provide **real-time, contextual, and predictiv

> “Real time quantitative measure of warfare scenario is an essential input to top decision maker for unde

> “...provide meaningful and real-time actionable insight.” (Abstract)

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## What Makes Something Actionable

- Integration of multi-source, heterogeneous data (battlefield, cyber, social)
- Use of predictive models and metrics tailored to warfare contexts
- Contextualization of raw data into threat posture, vulnerabilities, and operational readiness
- Real-time processing and alerting to anticipate events
- Feasibility through scalable, distributed computing infrastructure

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## How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** Information and Warfare Analytics System
- **Methods/Levers:** Big data processing via Spark MapReduce; MLlib for scalable machine learning; in
- **Operational Steps / Workflow:**
  1. Data generation & collection from multiple military, cyber, and open sources
  2. Preprocessing via ETL and Big Data Toolbox
  3. Distributed processing & analytics via Spark
  4. Application of statistical, ML, and SNA algorithms
  5. Computation of warfare metrics
  6. Visualization and decision support output
- **Data & Measures:** GIS, battlefield exercises, simulations, MASINT, HUMINT, OSINT; conventional v
- **Implementation Context:** Military decision support in both active conflict and peacetime intelligence m

> “...integration of Data Mining, Social Network Analysis, statistical and analytics techniques...” (Section I

> “...develop comprehensive set of warfare metrics.” (Abstract)

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## Dimensions and Attributes of Actionability (Authors’ Perspective)

- **CL (Clarity):** Yes — Outputs must be interpretable to top decision makers.
- **CR (Contextual Relevance):** Yes — Contextualization of multi-domain data into decision-ready insigh
- **FE (Feasibility):** Yes — Emphasis on scalable, commodity-hardware-based cluster solutions.
- **TI (Timeliness):** Partial — Near real-time capability mentioned but not exhaustively defined.
- **EX (Explainability):** Partial — Models’ logic partially described; domain-specific metrics aid interpreta
- **GA (Goal Alignment):** Yes — Explicit aim to support military strategic and tactical objectives.

- **Other Dimensions Named by Authors:** Predictive ability, resilience to data quality issues, multi-doma

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## Theoretical or Conceptual Foundations

- Network Centric Warfare (NCW)
- Information Age Combat Models
- Graph Theory for SNA
- Lanchester and Adaptive Dynamic Models for combat
- CVSS vulnerability metrics for cyber warfare

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## Indicators or Metrics for Actionability

- Conventional warfare: OLI, WEI, Lanchester, Adaptive Dynamic, Situational Force Strength
- Cyber warfare: Base, Temporal, Environmental metrics; probability of attack; system vulnerability; threa
- Social network: Centrality, Density, Diameter, Prestige, Sentiment, Topic Value, Scale Shift

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## Barriers and Enablers to Actionability

- **Barriers:** Data heterogeneity, incomplete/missing data, sensor inaccuracies, cross-vendor incompati
- **Enablers:** Distributed computing (Spark MapReduce), data preprocessing toolkit, integration of ML/S

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## Relation to Existing Literature

The paper builds on practical military analytics cases (e.g., NATO’s use of Twitter for intelligence, electro

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## Summary

The paper conceptualizes a comprehensive architecture for military decision support that operationalizes

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## Scores

- **Overall Relevance Score:** 90 — Strong, integrated conceptualization of actionability, with explicit link
- **Operationalization Score:** 88 — Detailed framework and workflow; some aspects (timeliness, explain

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## Supporting Quotes from the Paper

- “...provide meaningful and real-time actionable insight.” (Abstract)
- “Real time quantitative measure of warfare scenario is an essential input to top decision maker...” (Abstr
- “...develop comprehensive set of warfare metrics.” (Abstract)

- “...integration of Data Mining, Social Network Analysis, statistical and analytics techniques...” (Section II

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## Actionability References to Other Papers

- NATO social media intelligence collection (Ackerman, 2011)
- CVSS vulnerability scoring (First.org, 2015)
- Social Network Analysis theory (McCulloh et al., 2013)
- Lanchester and Adaptive Dynamic Models (Jaiswal, 1997)