

# A Review of Artificial intelligence approaches to network management

*Abstract—.*

**Index Terms—**Review, Artificial intelligence, Network Management

## I. INTRODUCTION

There are some labs focusing on machine learning, AI (artificial intelligence), self\* (self-configuring, self-healing, self-optimizing and self-protecting), cognitive of NM (network management). Table I shows the information of labs working on AI-based NM. To my best knowledge, it is ranked by importance.

Kumar, et al. [1], in 1997 a very early year, give a overview of the artificial intelligence in NM which is classified into **fault management, configuration management, accounting management, performance management, security management** but more expert system than AI technologies are discussed. 20 years later, [2] from University of Waterloo describes the overview of machine learning as the same classifications meanwhile they have explained more machine learning technologies and provided an impressive framework named C-MAPE (Cognitive-Monitor-Analyze-Plan-Execute over a shared Knowledge) in FIG.1. Then, in [5], Boutaba, et al. have a much more comprehensive discussion of machine learning on networking which has over 500 citations. It contains 8 directions: **traffic prediction, traffic classification, traffic routing, congestion control, resource management, fault management, QoS and QoE management, network security**, illustrated in FIG. 3.

Li Rongpeng, et al. [4] presents the artificial intelligence int context of 5G and have a different view of the classifications which are **radio resource management, mobility management, management and orchestration, service provisioning management**.

Jiang and Hanzo Lajos in [6] also provides a machine learning paradigms in 5G shown in FIG. 2. They distinguish the applications as the type of machine learning.

Qi, et al. [3] provides us a comprehensive discussion in network management.

## II. ARTIFICIAL INTELLIGENCE

### III. OVERVIEW OF NETWORK MANAGEMENT

#### A. Traffic Classification

[7] is a review of traffic classification. Then a lot of papers [8]–[10] discuss about it.

#### B. Traffic Prediction

[11] from Zhejiang University is about traffic prediction.

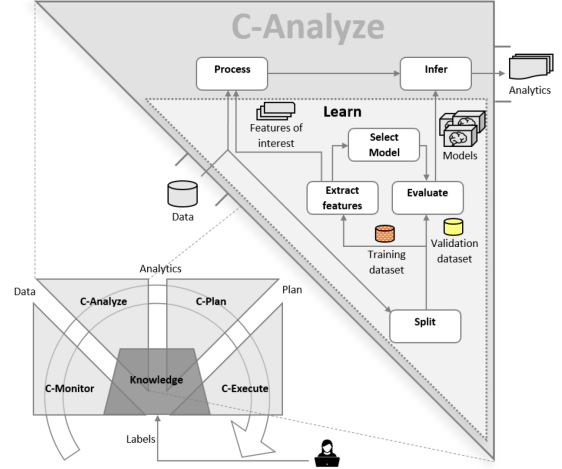


Fig. 1. C-MAPE.

#### C. Traffic Routing

Qadir [16] from Pakistan gives us a review about cognitive routing. [17]  
[18]

#### D. Mobility Management

[12] poses a AI framework for wireless network management which is used in a case of mobility management, where a ping-pong problem is addressed.

#### E. Service Management

[13] uses a reinforcement learning approach to optimize service.

[14], [15] presents reinforcement approaches to service slicing.

#### F. Fault Management

[19]

#### G. Security Management

[20], [21]

#### H. Source management

[22], [23] are about spectrum management.

#### I. Performance management

[25] used the RL to turning the management when performance degradation occurs. From my point of view, it have used the DQL (Deep Q-learning).

TABLE I  
INFORMATION OF LABS WORKING ON AI-BASED NM

Leader	Country	University	Personal Publications	collected papers	key words
Boutaba	Canada	University of Waterloo	500	2	
Honggang Zhang	China	Zhejiang University	300	7	
Hanzo Lajos	UK	University of Southampton	1400	2	
Riihijarvi J, Mahonen P	Germany	RWTH Aachen University	200	1	
P. Venkataram P	India	Indian Institute of Science		2	
Xiangming Wen	China	Beijing University of Posts and Telecommunications		2	
Qadir J.	Pakistan	National University of Sciences and Technology		1	
Sven G. Bilén	USA	Pennsylvania State University		1	

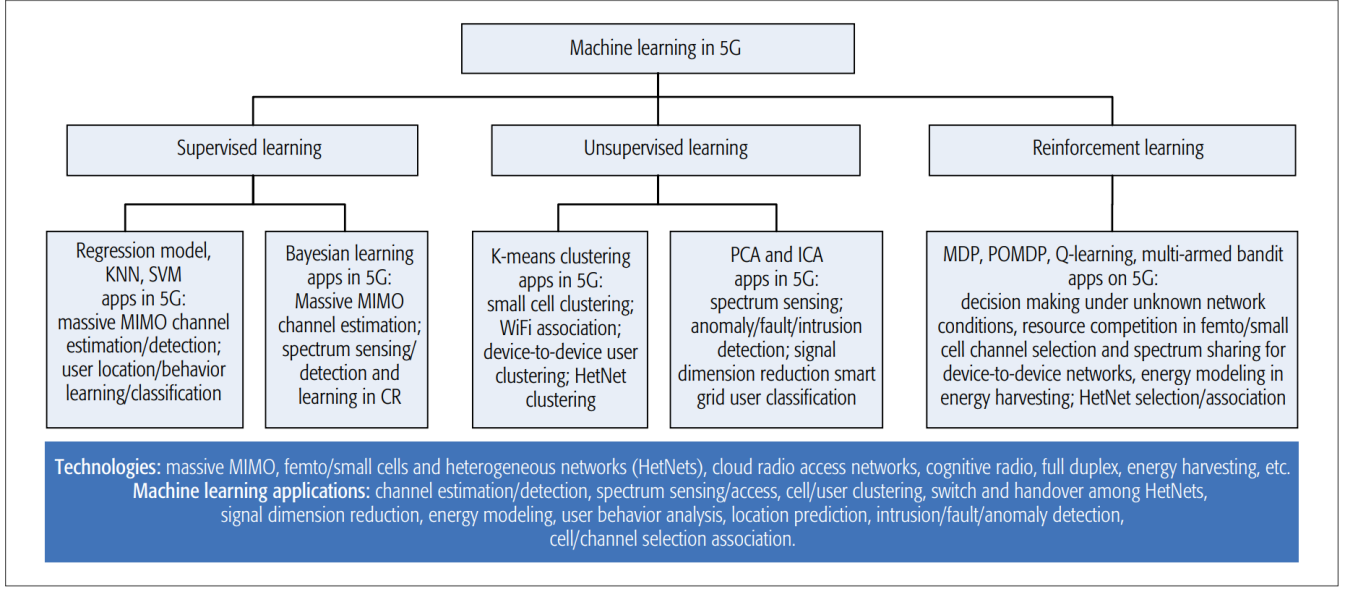


Fig. 2. Machine Learning in 5G.

## J. Platform

[24]

## IV. OPPORTUNITIES AND CHALLENGES

## V. CONCLUSION

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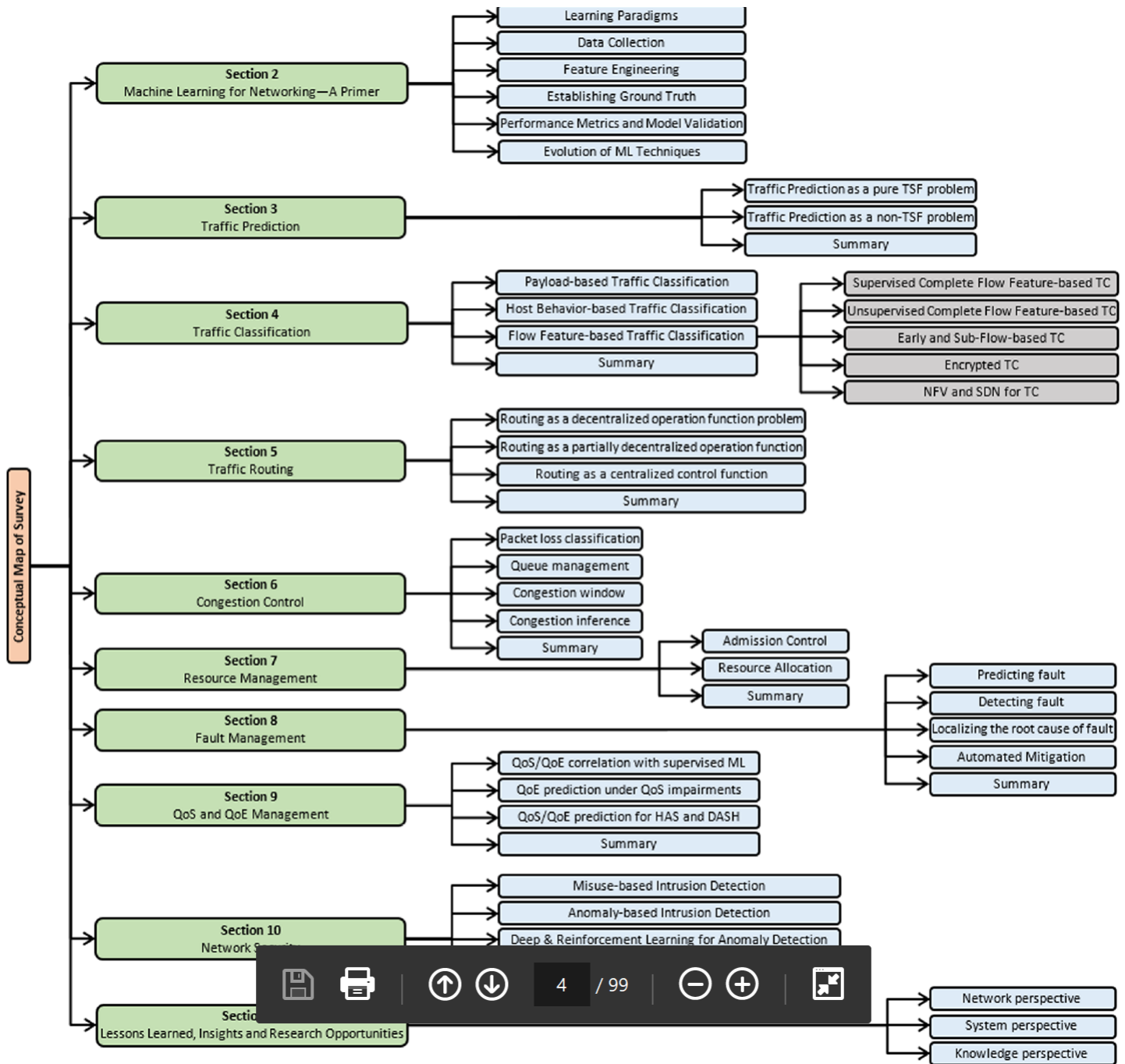


Fig. 3. Machine Learning in Networking

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