Healthcare Internet of Things (IoT): A Survey of Methods and Approaches

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Overview

- Machine learning in IoMT revolutionize healthcare through effective, precise, and privacy-preserving services.
- Challenges in existing IoMT models includes: energy consumption, complex data scheduling, low-latency models, privacy, joint offloading, limited data, and data security.
- Developing new training and optimization techniques helps in creating interpretative models for decision-making.
- ML advances the development of efficient, accurate, and privacy-preserving healthcare services

Introduction

- IoT is a network of connected physical machines, sensors, and gadgets, that can gather data.
- IoT edge devices have shown growing potential for use in the healthcare industry to:
  1. track and monitor a patient's health [1]
  2. gather and analyze data [2]
  3. offer real-time support/feedback to healthcare professionals [1]
- With the adoption of IoT for healthcare, practitioners can monitor a patient's vital signs and other crucial health indicators in real-time.

IoMT: Application Architecture

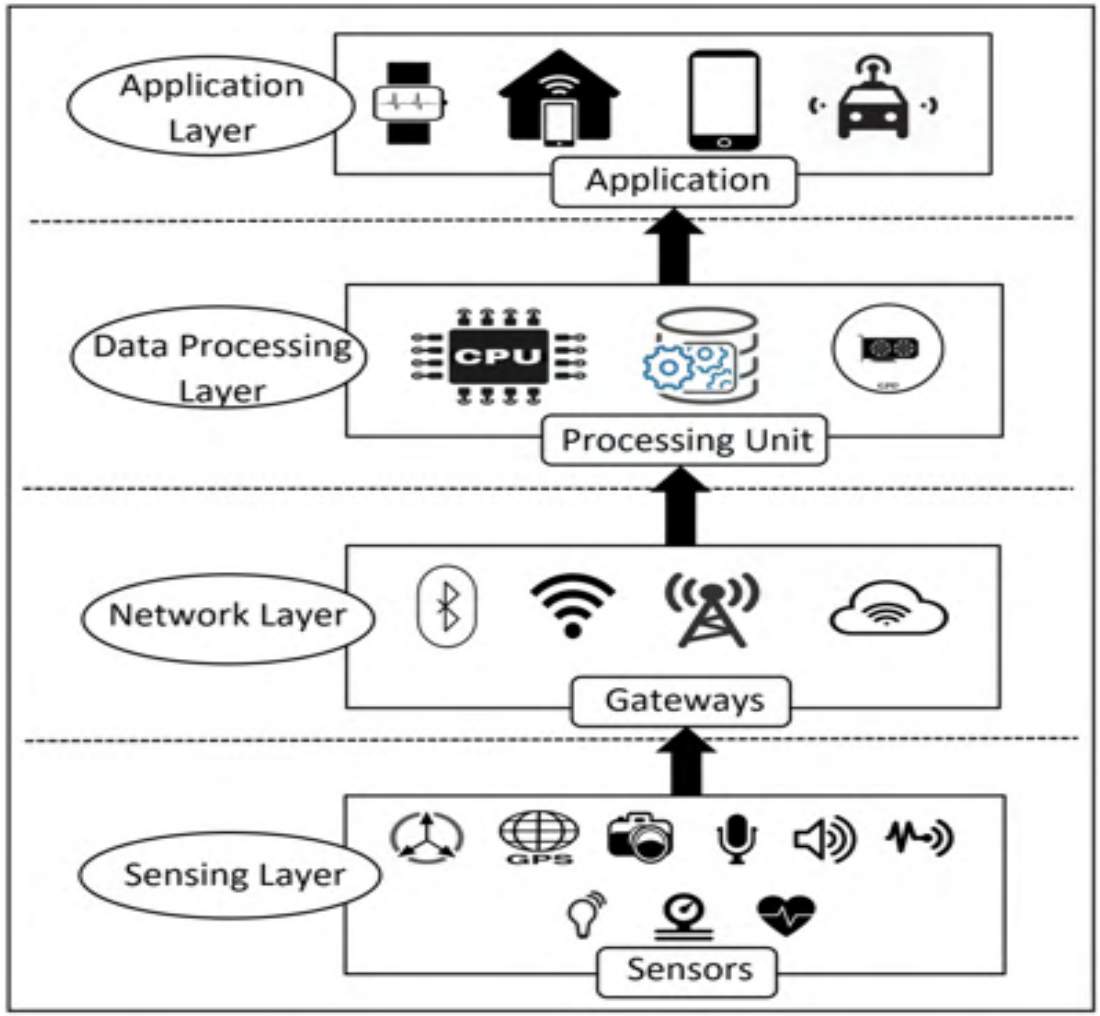

Figure 1: Internet of Things Layers - Architecture.[3]

Summary of IoMT Architecture

Ref	Purpose	Method	Contribution	Issues	Solution
[4]	Intelligence edge	Fog Comp	Reduce Latency	Energy Cons.	AD Classification
[5]	Timely processing	Edge Comp	Reduced EC	Runtime	GAN for SD
[6]	Anomaly Detection	Edge Comp	Cluster Class.	Model Run time	Hybrid AD and SD
[7]	Cost Efficiency	intraWBANs	NASH Equil.	Latency and EC	Geometric Transf.
[8]	Patient Monitoring	RAMi	High Freq./Data	Runtime	Naive Bayes Algorithm
[9]	Implantable Ultrasonic	Modular Arch.	Low-power Ultrasonic	High EC	Random Forest Class.
[10]	Power-surge probability	interWBAN, IWC-IoMT	Energy Efficiency	High EC	DNN for SD

IoMT: Network

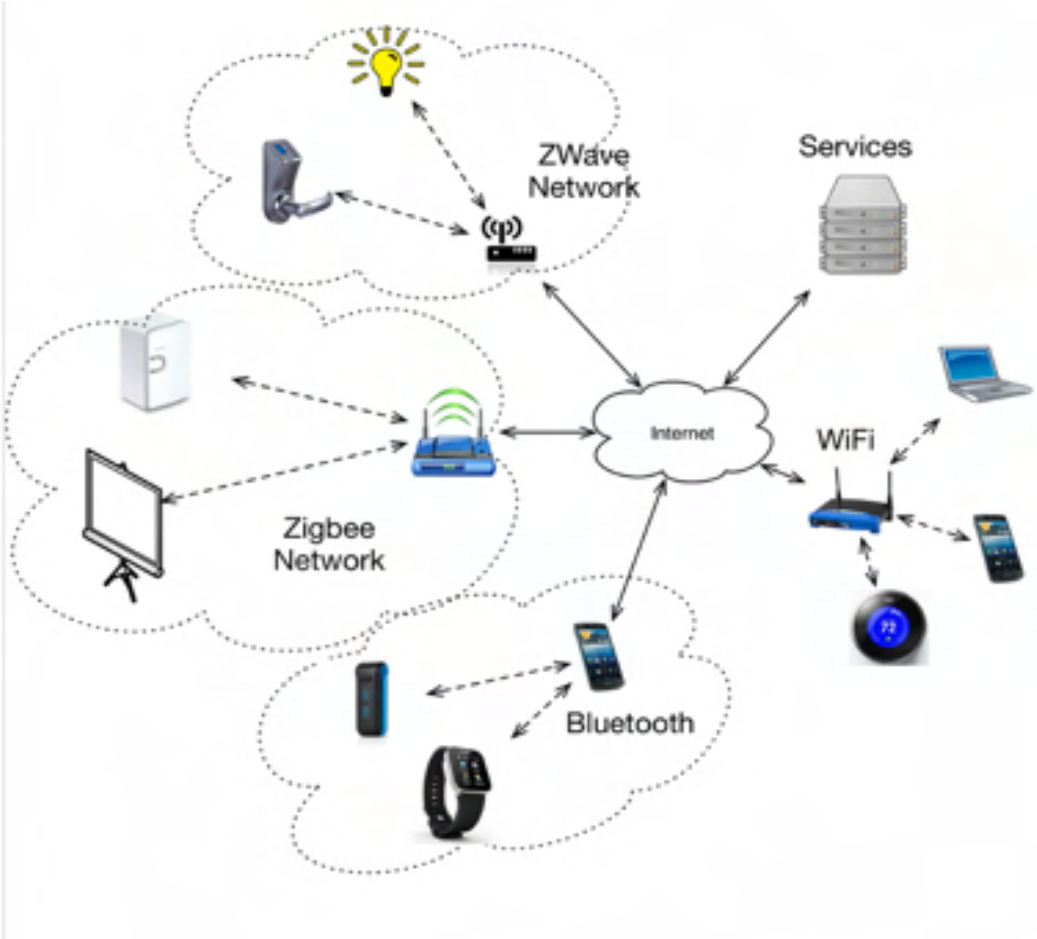

Figure 2: Layers of Internet of Things - Network. [11]

Summary of IoMT Networks

Ref	Purpose	Method	Contribution	Issues	Solution
[12]	Fog Layer IoMT	Fog Layer	Reduce Latency	Energy Con. and Privacy	EM Algorithm
[13]	Task Offloading	Learning model	URLLC Constr.	Joint Offloading	UTO-EXP3
[14]	5G-NR Monitoring	5G Taxonomy	Reduce Latency	EC	AD Classification
[15]	D2D IoMT Trust	Fuzzy Trust Inferring	Detection Accuracy	Model Run time	Data Augmentation
[16]	Security and Privacy Class.	BLE, NFC and RFID	IoMT Taxonomy	Limited Data	Hybrid AD and SD
[17]	Analyzing Behaviour	Deep-Belief NN	Behaviour Detection	Data Security/Privacy	Federated Learning

IoMT: Machine Learning

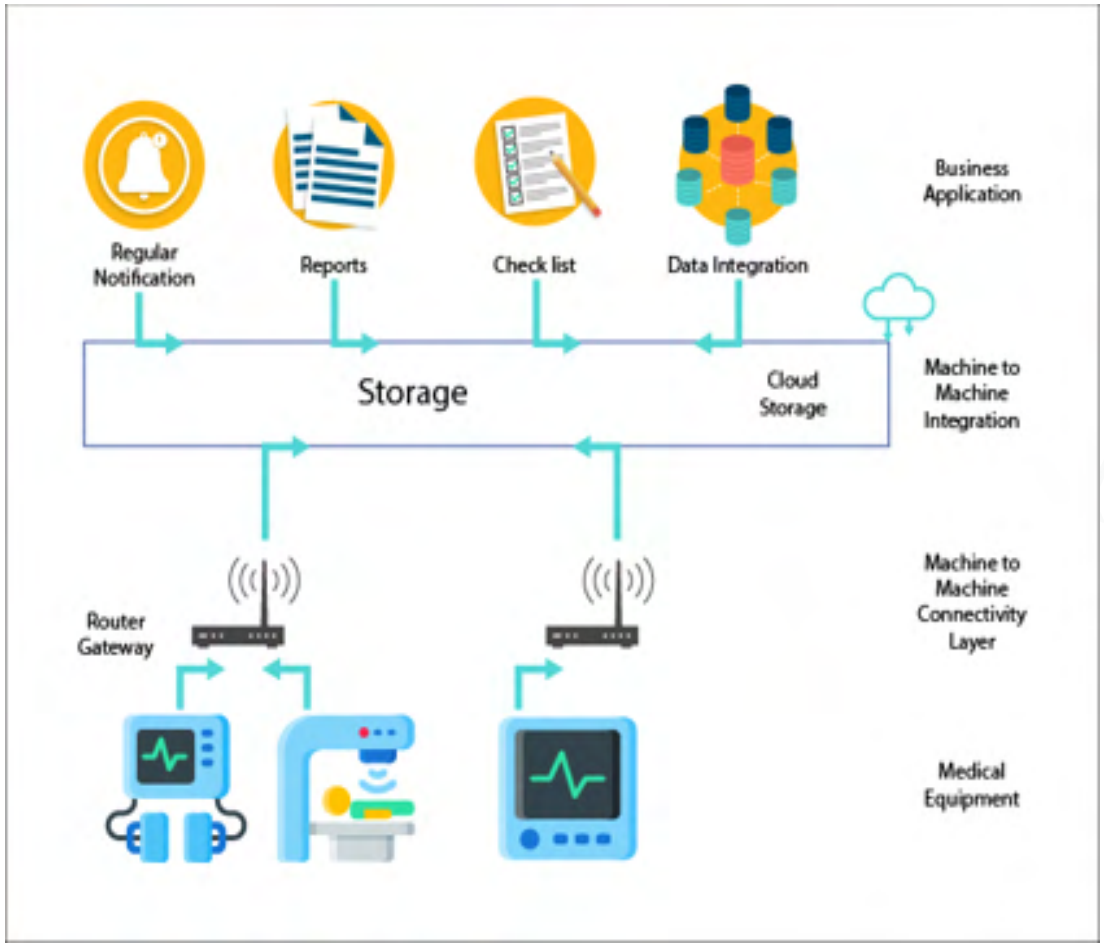

Figure 3: Layers of Internet of Things - Machine Learning.[18]

Summary of IoMT Machine Learning

Ref	Purpose	Method	Contribution	Issues	Solution
[19]	Alg. for Edge Devices	CMOS and FinFET	VLSI Design	Scale Reduction	Transfer Learning
[20]	Task scheduling	Deep Learning FC	Accuracy	CDS	DT and Clustering
[21]	Medical Volume Data	Robust Watermark Alg.	Fewer Features	Overhead	Batch Gradient Descent
[22]	Privacy preserving	K-Medoids Clustering	Laplace Noise	Model Runtime	Model Compression
[23]	Data quality/-Precision	Predictor-corrector Alg.	Improved Precision	EC and Run time	Knowledge Distillation

Research Gap

Current state of the art models for egde devices in IoMT are still plagued by the following:

- Energy inefficient models
- Complexity in data scheduling
- High-latency models
- Data privacy concerns
- Lack of data/model scalability
- Model overheads

Recommendations

- Explore novel architectures
- Investigate new training and optimization techniques
- Develop interpretative models
- Design models for low-resource environments
- Address ethical and fairness issues
- Improve scalability and generalization

Conclusion

- It is essential to address the shortcomings of IoMT models at the cutting edge in order to provide more accurate, timely, and private healthcare services.
- The development of IoMT algorithms that take important factors like model accuracy, precision, and efficiency into account will enhance the IoT industry and open up new applications that can be advantageous to society.

References

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[2] A. Ganapathy, "Edge computing: Utilization of the internet of things for time-sensitive data processing," *Asian Business Review*, vol. 11, no. 2, pp. 59–66, 2021.

[3] A. K. Sikder, G. Petracca, H. Aksu, T. Jaeger, and S. Uluagac, "A survey on sensor-based threats to internet-of-things (iot) devices and applications," 02 2018.

[4] A. M. I. Patel, P. and A. Sheth, "On using the intelligent edge for iot analytics," *IEEE Intelligent Systems*, vol. 5, no. 32, pp. 64–65, 2017.

[5] [illegible]