AI-based Resilience for IoT-enabled Business Processes

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Introduction

- Business Processes dealing with IoT applications face challenges of missing data.
- Execution of Business Processes may fail if the required data is incorrect or unavailable.
- Quality-of-Service degrades or undermines when there are missing values.
- A closer integration of AI and BPM community is needed to address the problem and enhance the resilience of the IoT-enabled Business Process.
- Without classical AI-driven decision trees, it would be difficult to get a comprehensive solution.

Related Works

- Most of the state-of-the-art methods recognize the activities after evaluating the activity data through various ML algorithms [1].
- Lost data is imputed using data imputation techniques[2].

Integration of BPM, IoTs and AI

- It is important to overcome the effects of missing data.
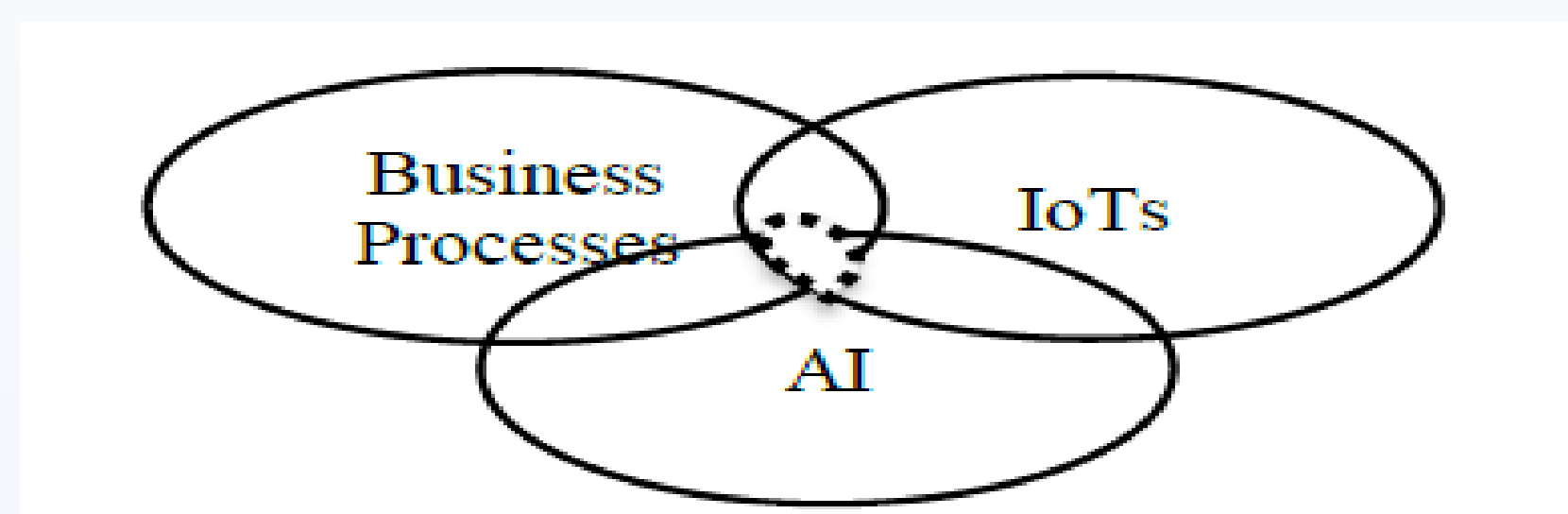- A closer integration of Business Processes, IoTs, and AI helps in improved decision-making.

Figure 1: Integration of BP, IoT and AI

Decision-Making for Human Behaviour Recognition(HBR)

- Activity classification is the process of associating extracted features with particular activity classes.
- Activity class (types) cannot be estimated when there is no sufficient data available.
- The performance of the classification model suffers when data from one or more sensors is missing at certain time periods.
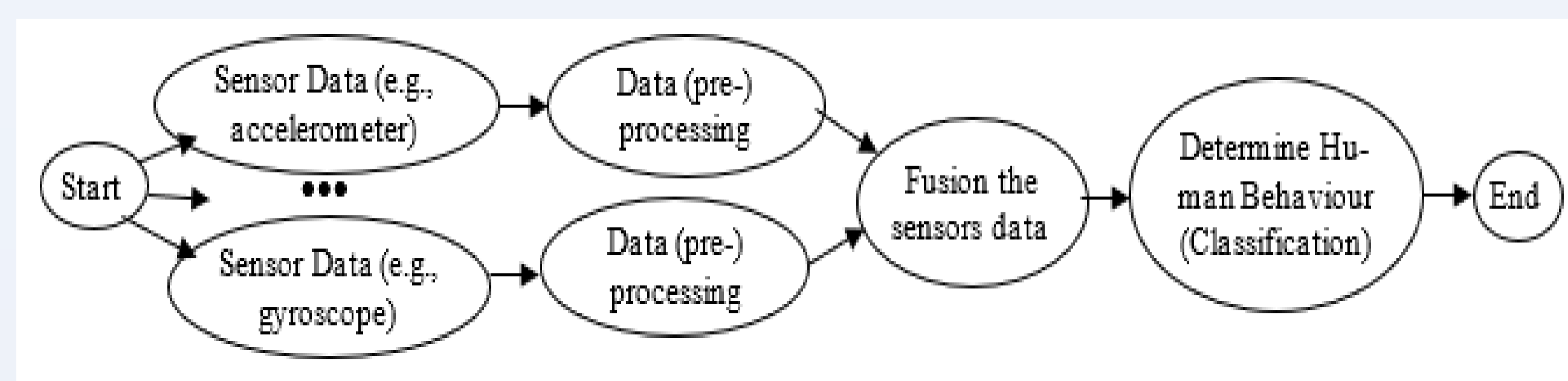

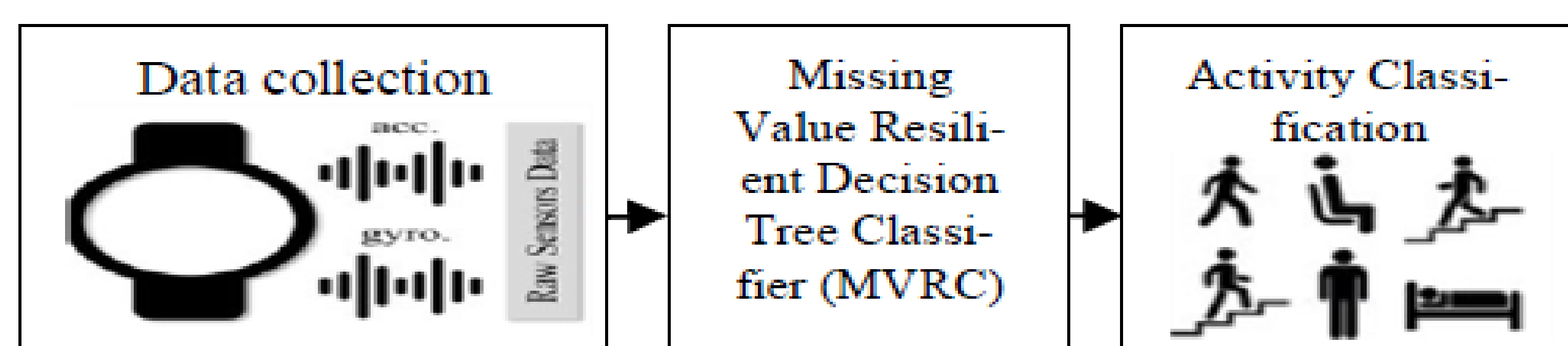**Figure 2**: Business process of determining human behavior from sensors

Figure 3: Activity Classification using Sensor data

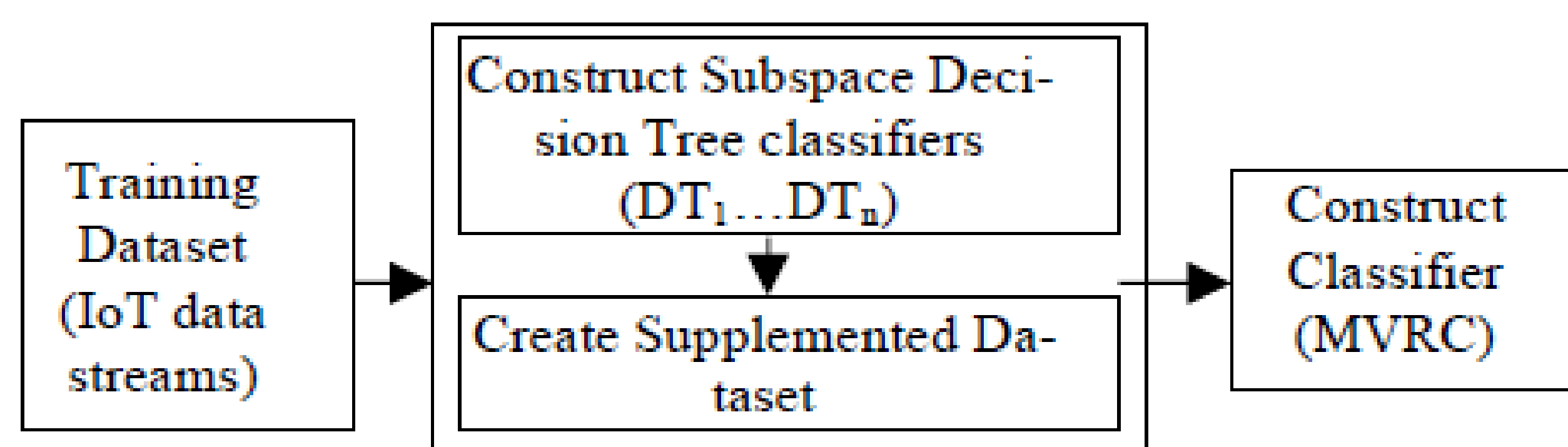## Working of Missing Value Resilient Decision Tree Classifier (MVRC)
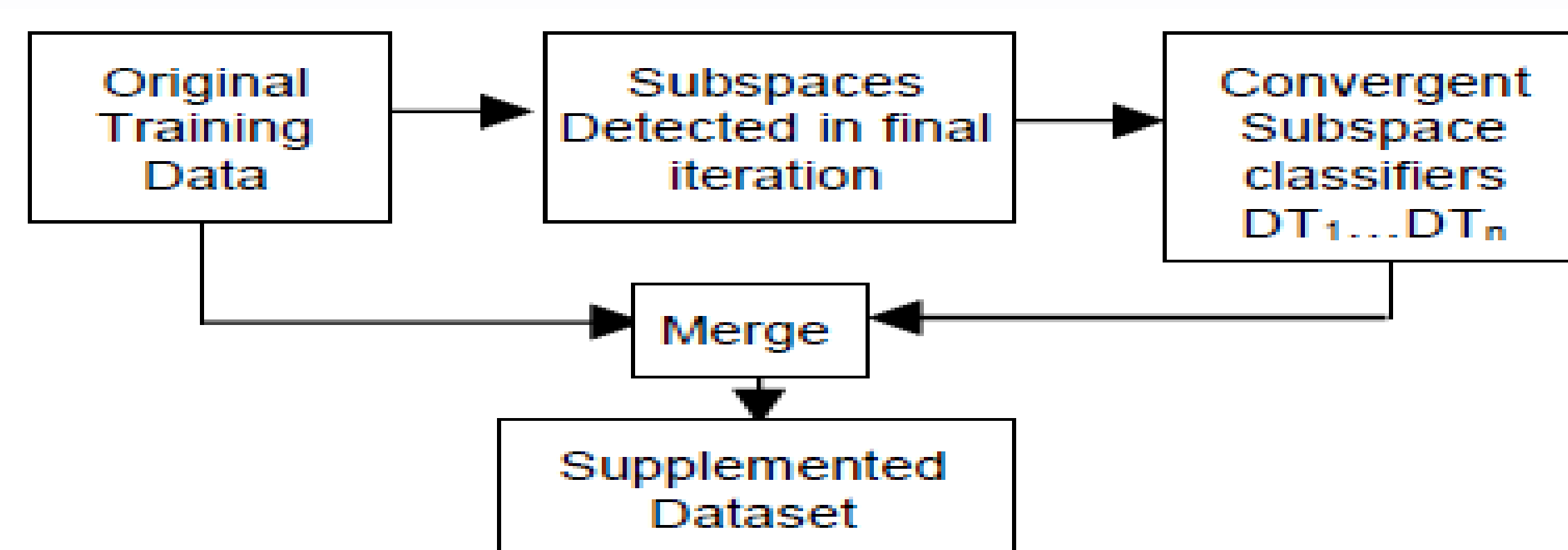

Figure 4 Overview of MVRC classifier

Figure 5. Overview of constructing supplemented dataset

- The Motion dataset consists of data related to the sensors of the Gyroscope and Accelerometer which are used to find the driving behavior of drivers to avoid road accidents.

AccX (0)	AccY (1)	AccZ (2)	GyroX (3)	GyroY (4)	GyroZ (5)	Timestamp(6)	Class
0.758194		0.457263				818922.0	Normal
0.667560	-0.038610	0.231416			0.225257	818923.0	Aggressive
2.724449	-7.584121	2.390926	0.023824		-0.038026		Slow
	-0.68167		0.042913	.00366		818923	Aggressive

Table 1: 50% missing data from 4 example objects

- For the four objects, based on the missing values, our approach chooses the three trained sub-space classifiers and classifies, matching with the ground truth.
- Address the presence of missing data in the activity/behavior recognition without data imputation and classify the activities effectively.

Discussion and Open Issues

- AI-driven resilient business process solutions for complex IoT business processes with underlying uncertainty in data in data availability and completeness.
- Determining cases of failures in IoT business processes by using causality AI solutions detection.
- Enhancing resilience of IoT business processes by incorporating AI techniques.
- Continuous monitoring of IoT business processes to predict and prevent potential failure by using predictive analytics.
- Optimized (or re-specified) data flows, control flows, and event flows for business process automation in IoT applications.
- AI-driven state transfer for replacement sensors to optimize storage, energy, and execution for efficient IoT business processes.