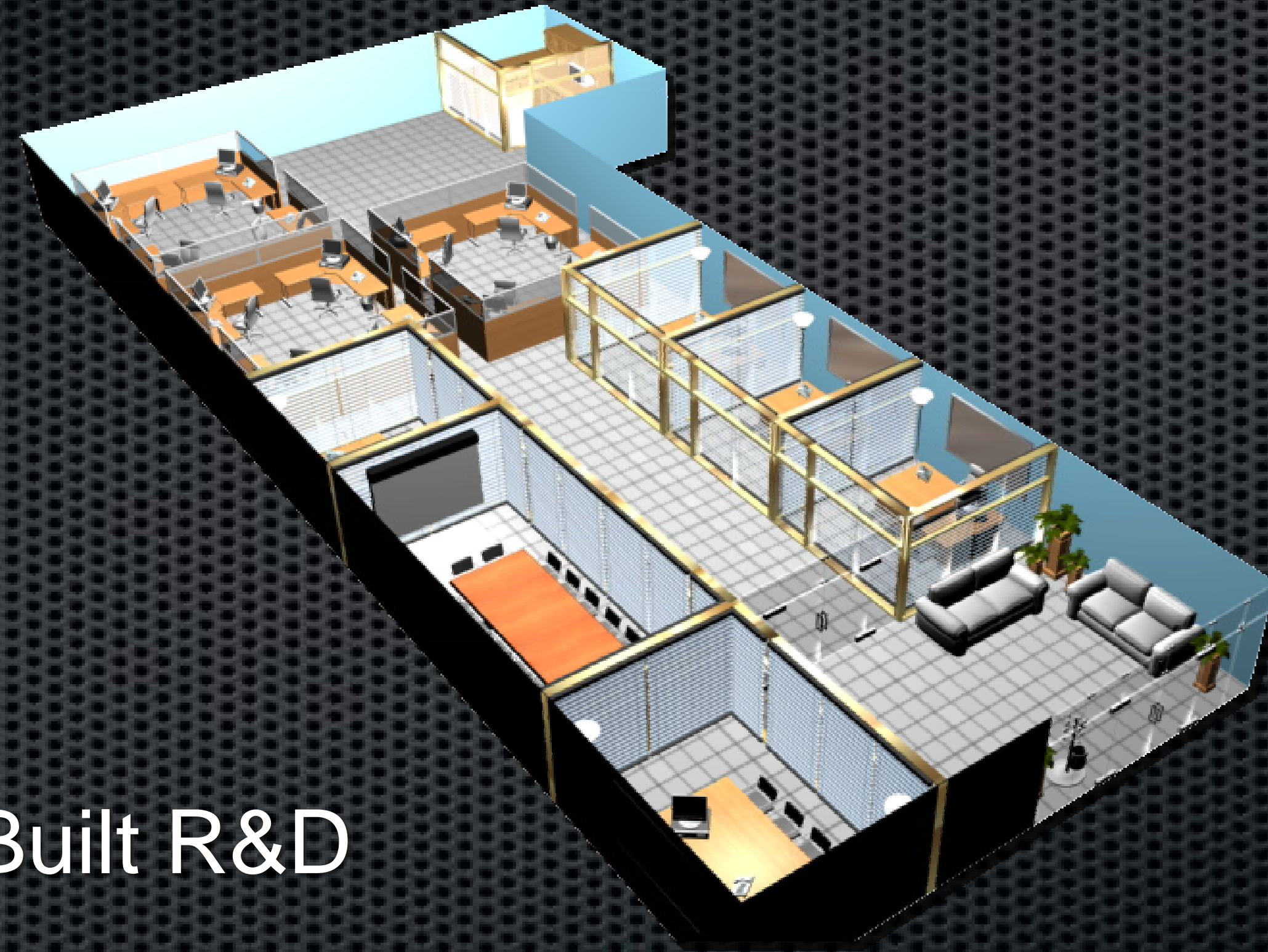




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University of Portsmouth - IIR



Custom Built R&D



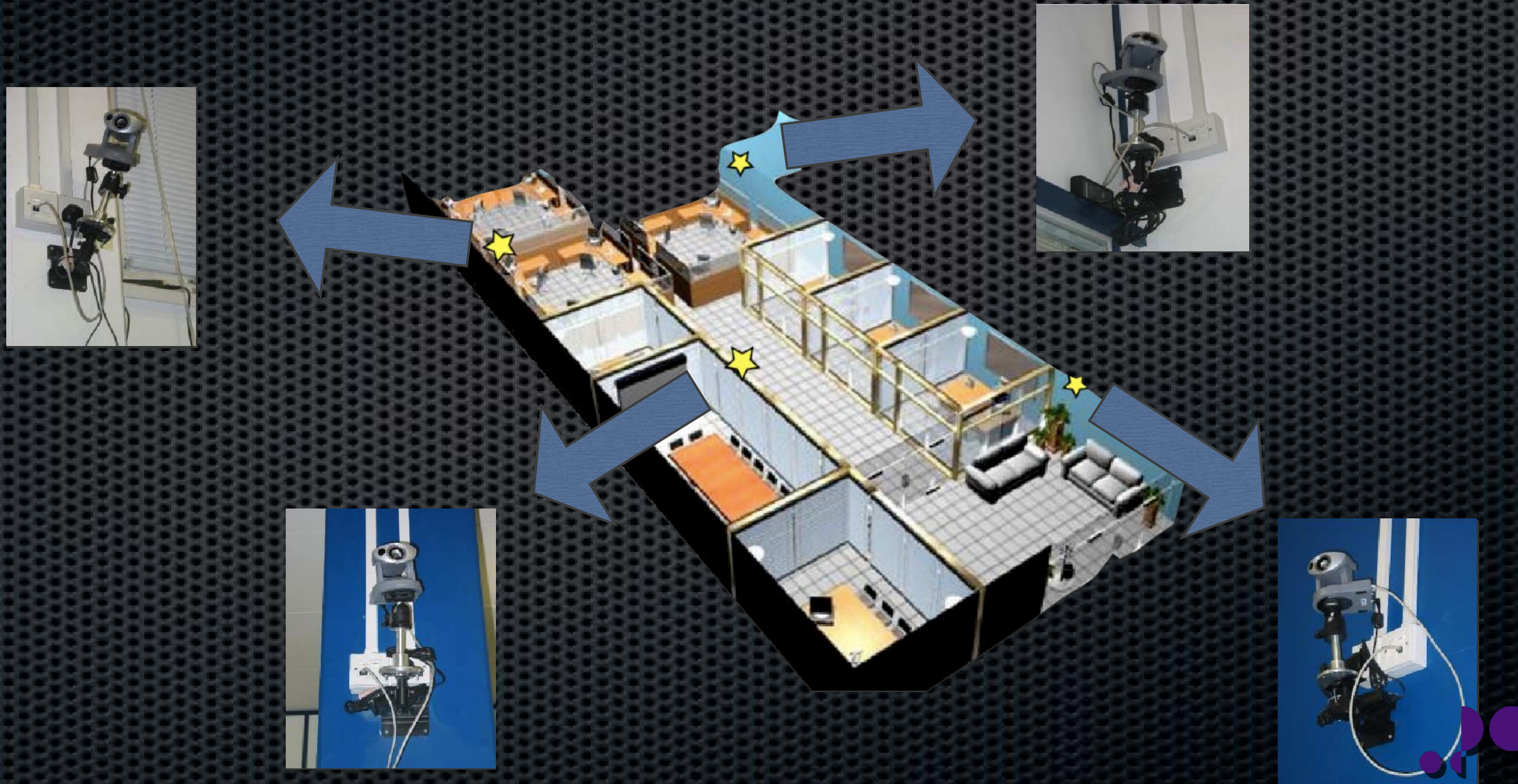
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- We have been involved in many AI industrial applications. These include diagnostics and failure prediction for process machines, embedded intelligence for management systems and medical analysis.
- We are always keen to form partnerships with industry.



Human Motion Analysis



Application Domain

- Security
- Sport Sciences
- Military
- Medical
- Robotics
- Traffic Management



Potential Application-Metro



Question

Where is agent 1?

What is agent 1 doing?

Why agent 1 is there?

Our approach + Description logic

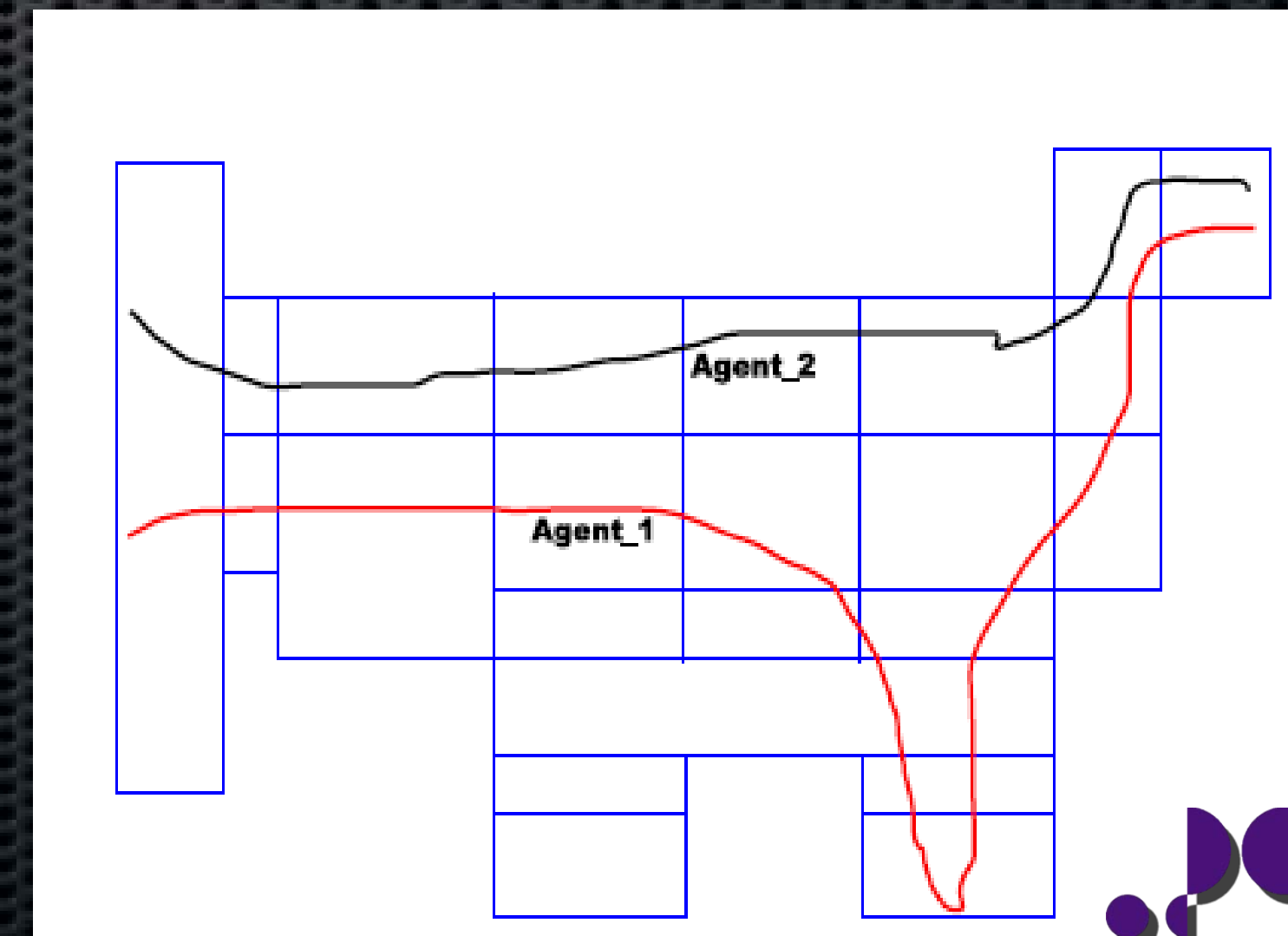
Motion detected (Agent_1, walk)

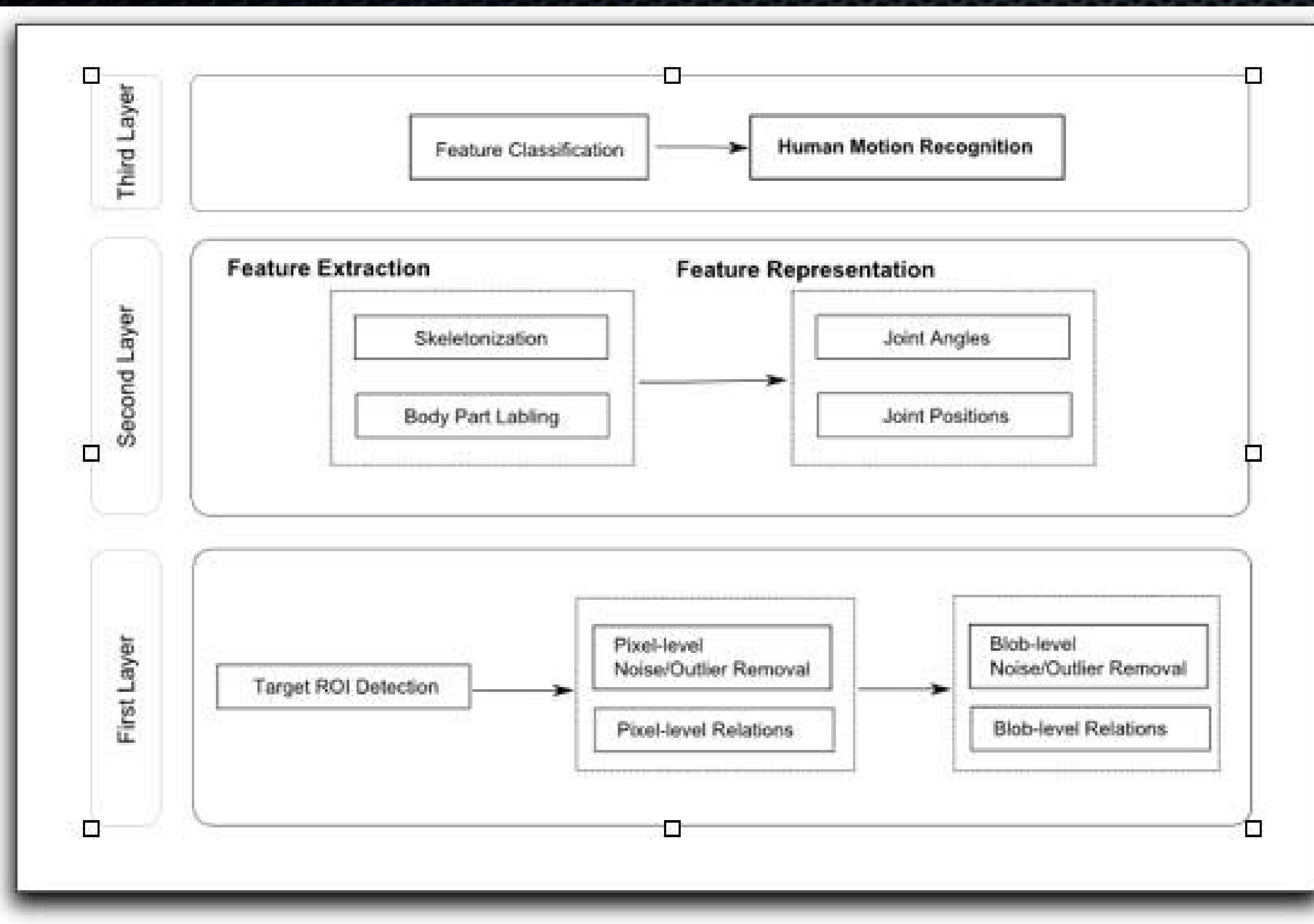
Speed (Agent_1, normal)

Location(Agent_1, TM2)

Approaching (Agent_1, Ticket machine)

Subway_Platform	Segment_16	AG2	Segment_13	Segment_10	Segment_8	Segment_5	Segment_2	Segment_1
		AG1	Segment_14	Segment_11	Segment_9	Segment_6	Segment_3	Segment_4
			Segment_12		Segment_7			
		Waiting_Line						
		Segment_15						
			TM1		TM2			
			Ticket Machine		Ticket Machine			

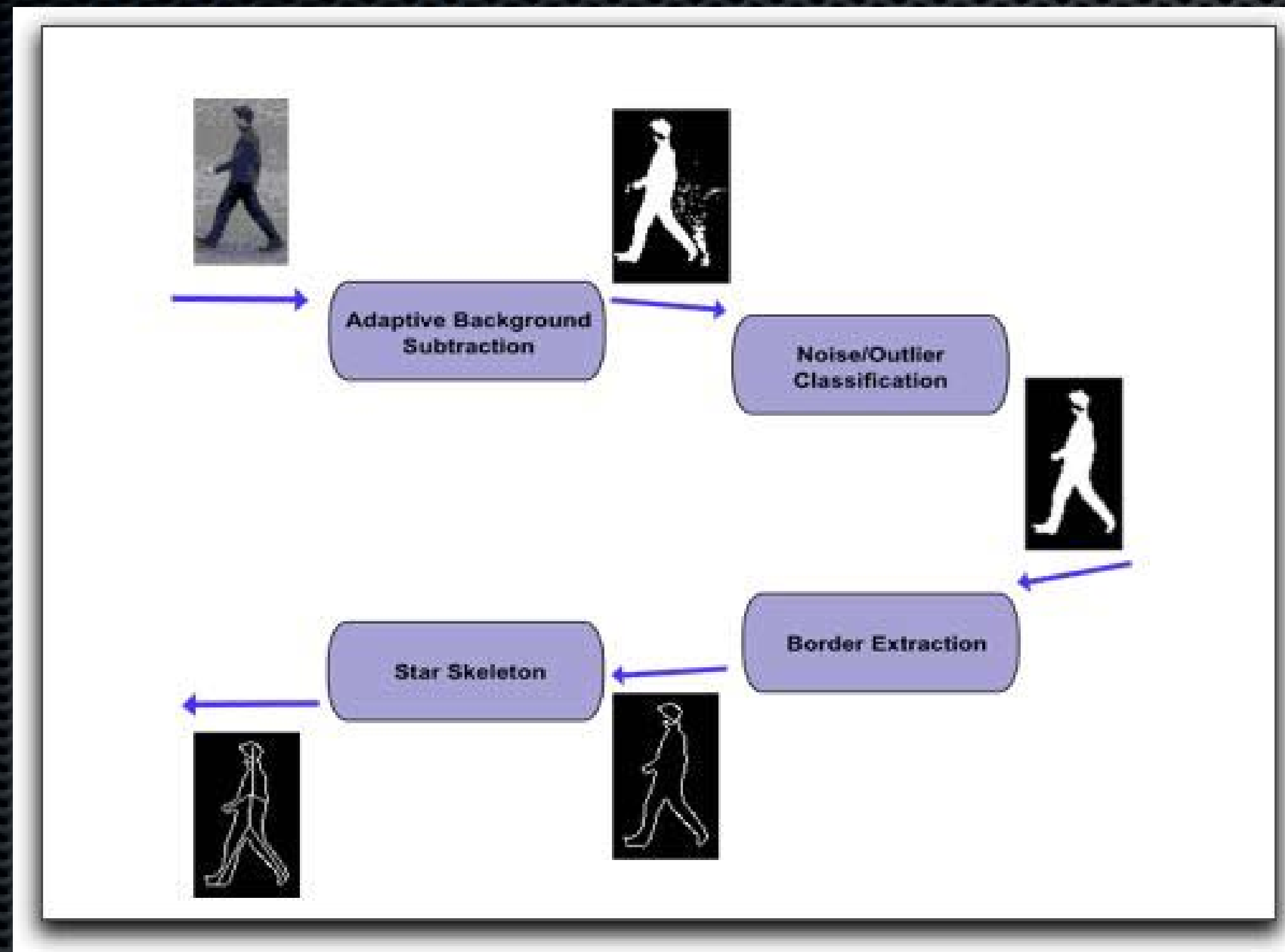




Framework For Recognition



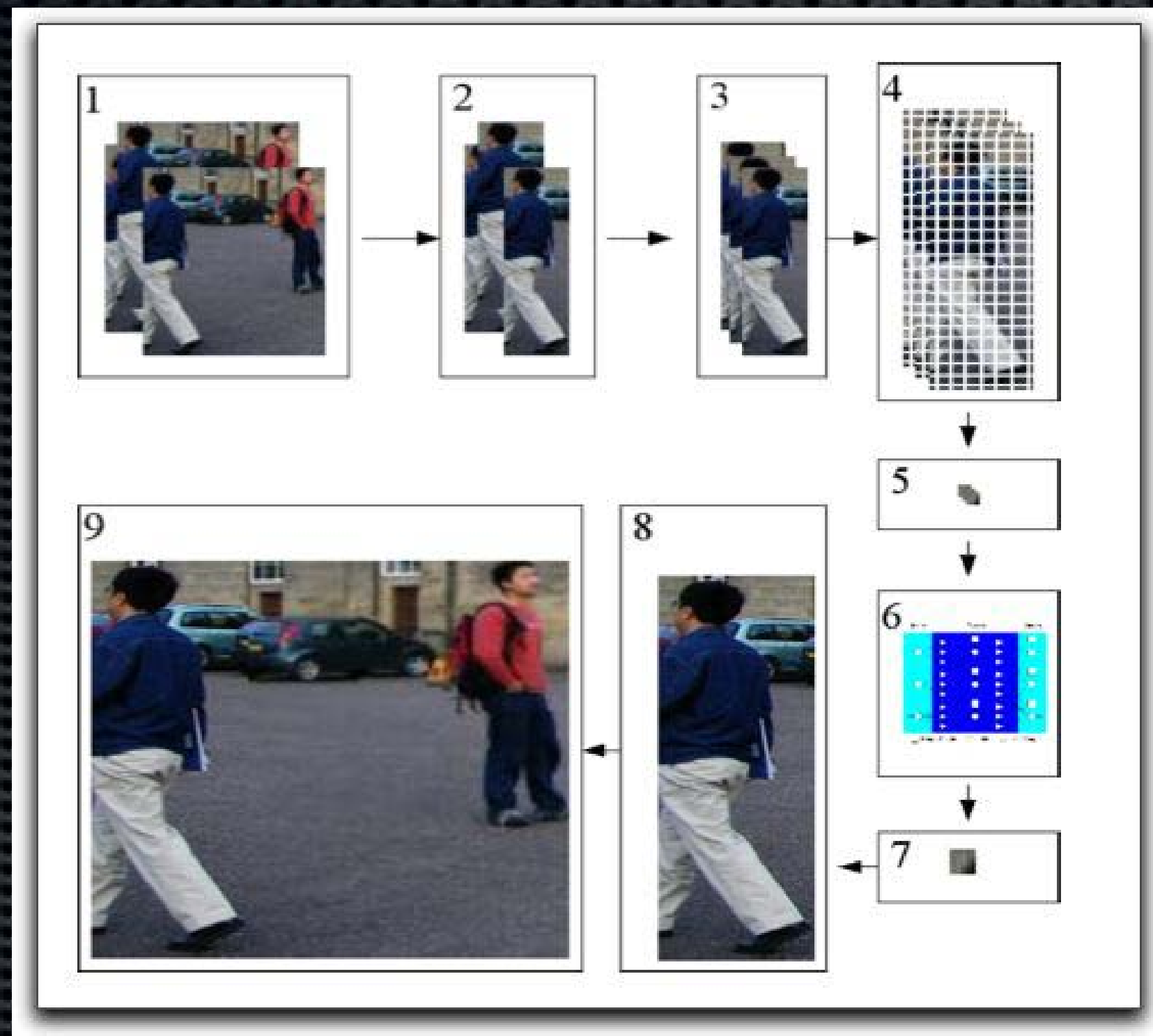
Detection and Feature Extraction



- Target ROI Extraction
- Noise Removal
- Outlier Detection
- Feature Extraction



Intelligent Image Enhancement



- Multiframe
- Intelligent
- Real-time
- Robust



Feature Extraction

- Motion Capture Data (BVH at 120 fps)
- Body simplified to 19 joints
- Each joint is seen as having three degrees of freedom. The rotations of such joints are represented by Euler ZXY angles.



Tracking the Features



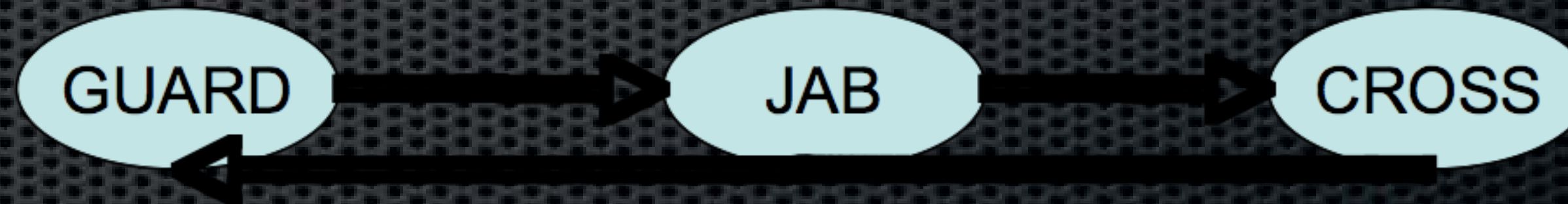


Extraction of intermediary states such as:

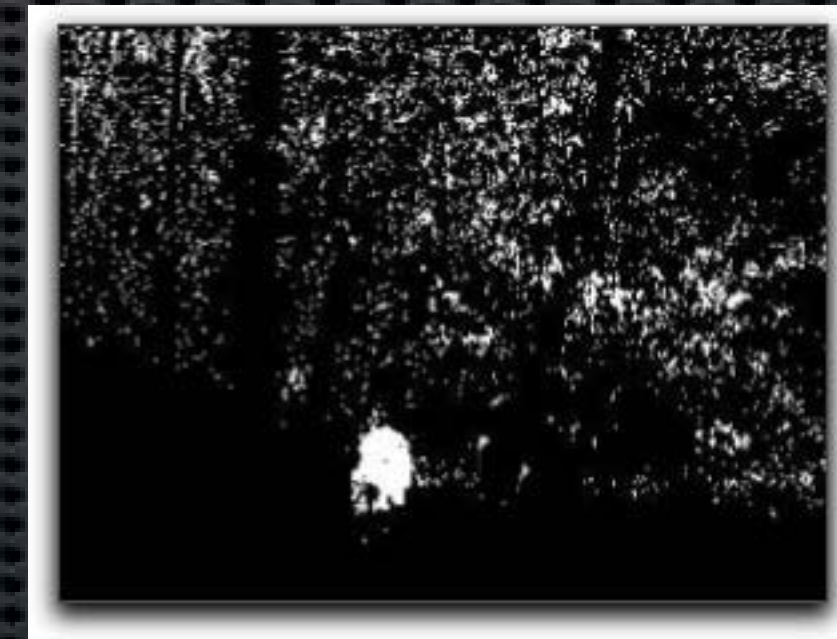
- GUARD
- EXTENDED ARM JAB
- EXTENDED ARM CROSS



Space-State Motion recognition:



Everyday Surveillance



Fault Diagnoses for a 3-phase brushless DC motor using a Feature Selection and Evaluation Algorithm

Operates online and is non-invasive it does not interrupt machine operation

Software based system, flexible; it can be improved and upgraded over time without hardware changes



Advanced Motor Needs Diagnostics



How it Works ?

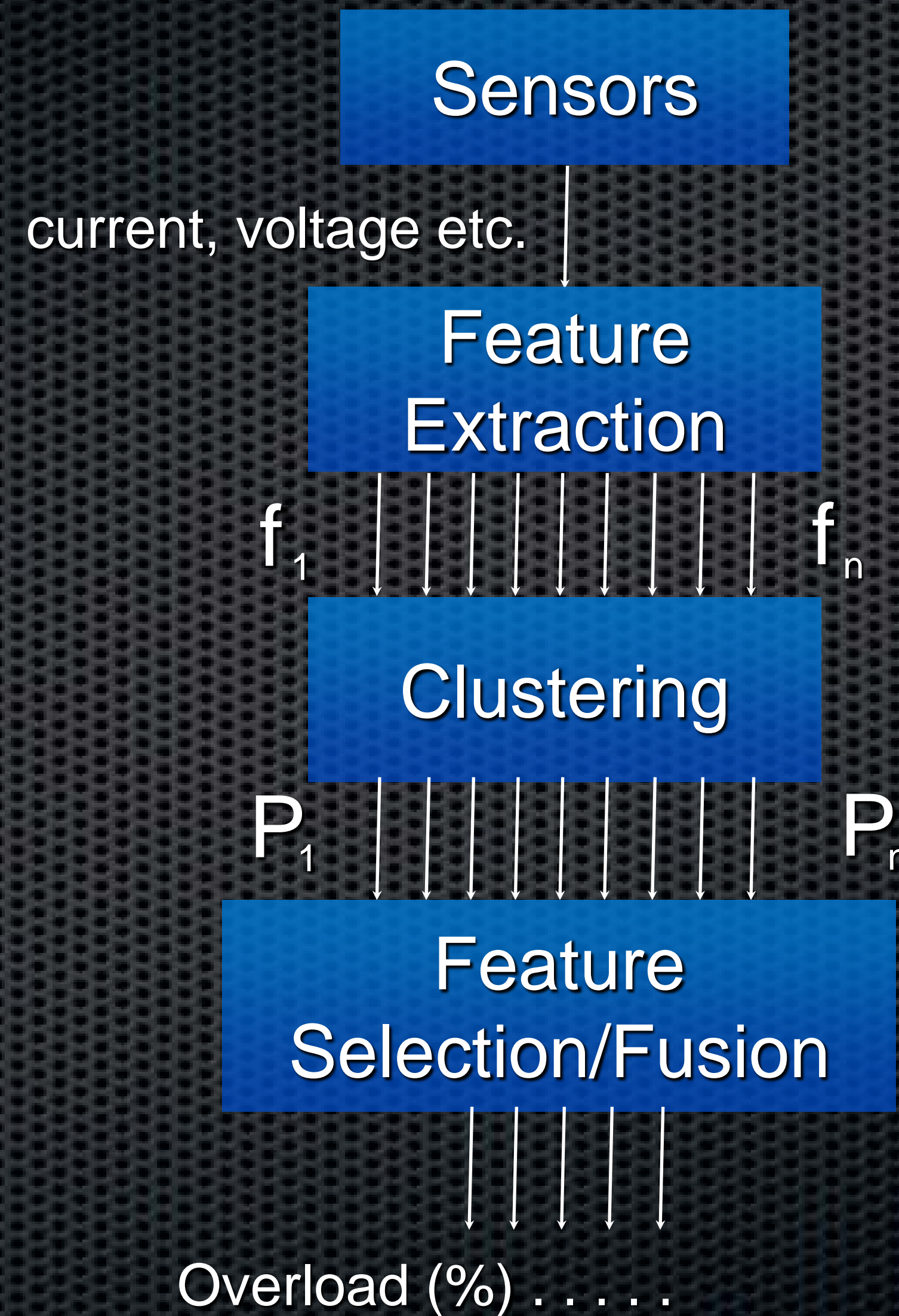
5 Stages:

- Data Preparation
- Feature Extraction
- Clustering
- Feature Selection
- Fault Confidence Calculation

Novelty in the Final 2 Stages



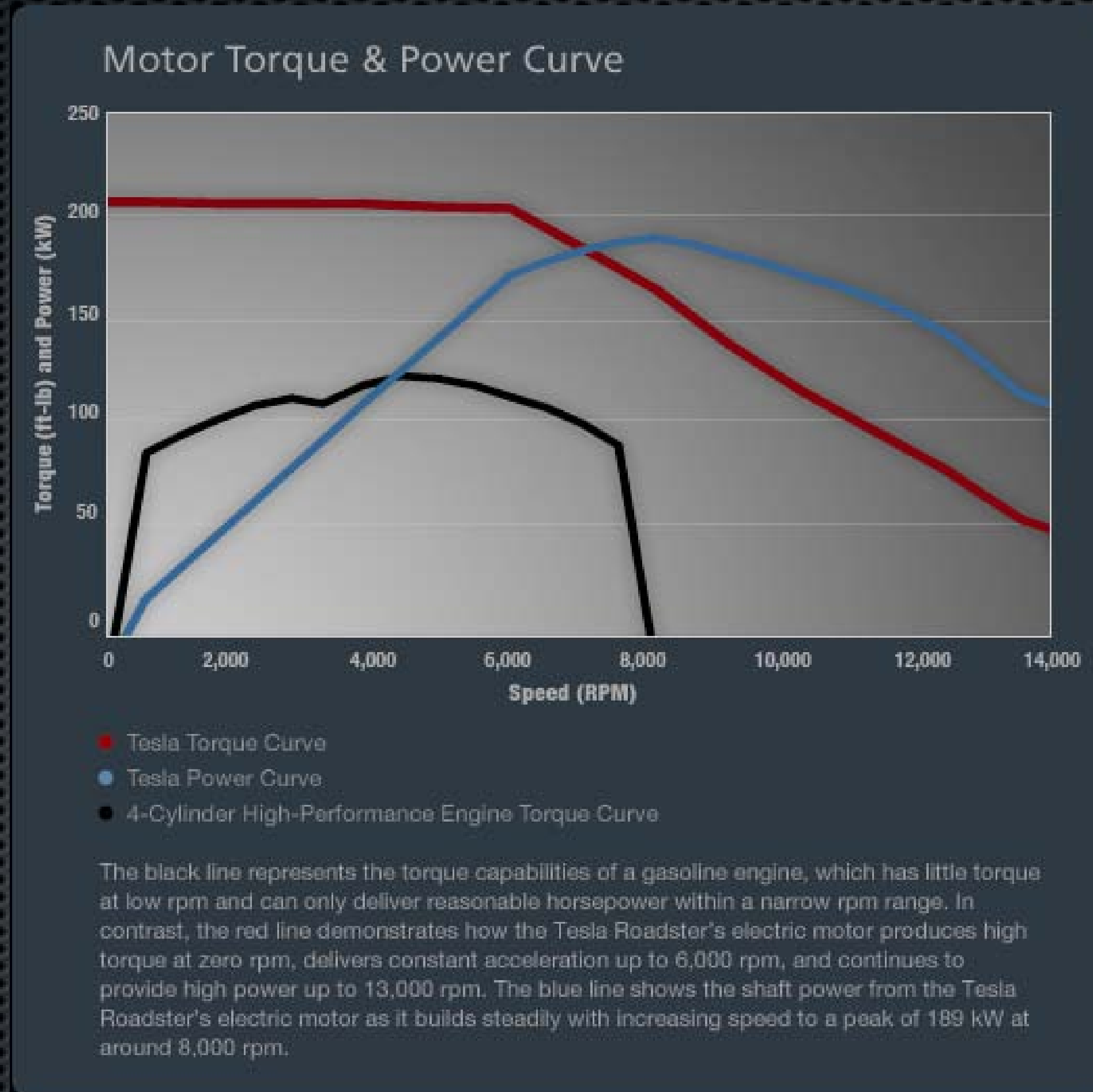
Framework Overview



The proposed method :

- Able to mix machine features and understand the importance of them during a variety of modes of operation.
- It will provide levels of certainty for each event that is happening.
- Gaussian clustering is used for the main algorithm, a new scoring method aids in evaluation of the features in different scenarios.
- The system is stable in presence of noise and maintains its reliability.
- Advantage of this clustering method is it can detect a previously unknown fault in the system and adapts to the new scenario.

Improved Performance needs Improved Diagnostics



To stress the advantages of our technique which are as follows:

1. A smaller number of existing sensors (current sensors at the moment) are used for fault classification. Significant advantage as the more sensors used the more expensive and unreliable the system can become.
2. The new algorithm is able to understand the significance of different indicators and change their priority (such as frequency and related harmonics) in different modes of operation of the motor. Important as the motors in electric vehicles will work over a wide range of speeds and varying load conditions.
3. The adaptively of the algorithm can also help provide good results in difficult scenarios for example where a large amount of noise is present (such as in severe ambient conditions). Critical if used in electric vehicles.

advantages cont.:

4. The algorithm outperforms the most advanced alternative method such as a (15 layer) Neural Network fault detection system.
5. The algorithm is able to perform online and in real-time (10-30 seconds response time).
6. The algorithm can tune itself to a wide range of motor sizes; this is imperative because its usage is for small to large electric machines for example from small town cars to long distance coaches.

Demo Summary

A board is designed to collect the data in different conditions of motor. Four types of faults are introduced.

- Motor Overload
- Disconnection of Phase 1
- Disconnection of Phase 2
- Disconnection of Phase 3

More can be added later !



Collaboration

- ▶ Access to challenging real-life data
- ▶ Access to expert knowledge

Any Questions ?

15/07/09



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