

Using Prediction to Conserve Energy in Recognition on Mobile Devices

IEEE International Conference on Pervasive Computing and Communications 2011

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Problem:

- Mobile devices are expected to be aware of situations, contexts and activities of their owners
- Classification incurs increased consumption due to processing and sensor usage
- Battery lifetimes have not been able to keep up with rising resource demands

Solution:

- Use **prediction** to infer which situations are likely to occur and exclude those which are unlikely
- Configure hardware and software to **deactivate sensors** which will not likely be needed

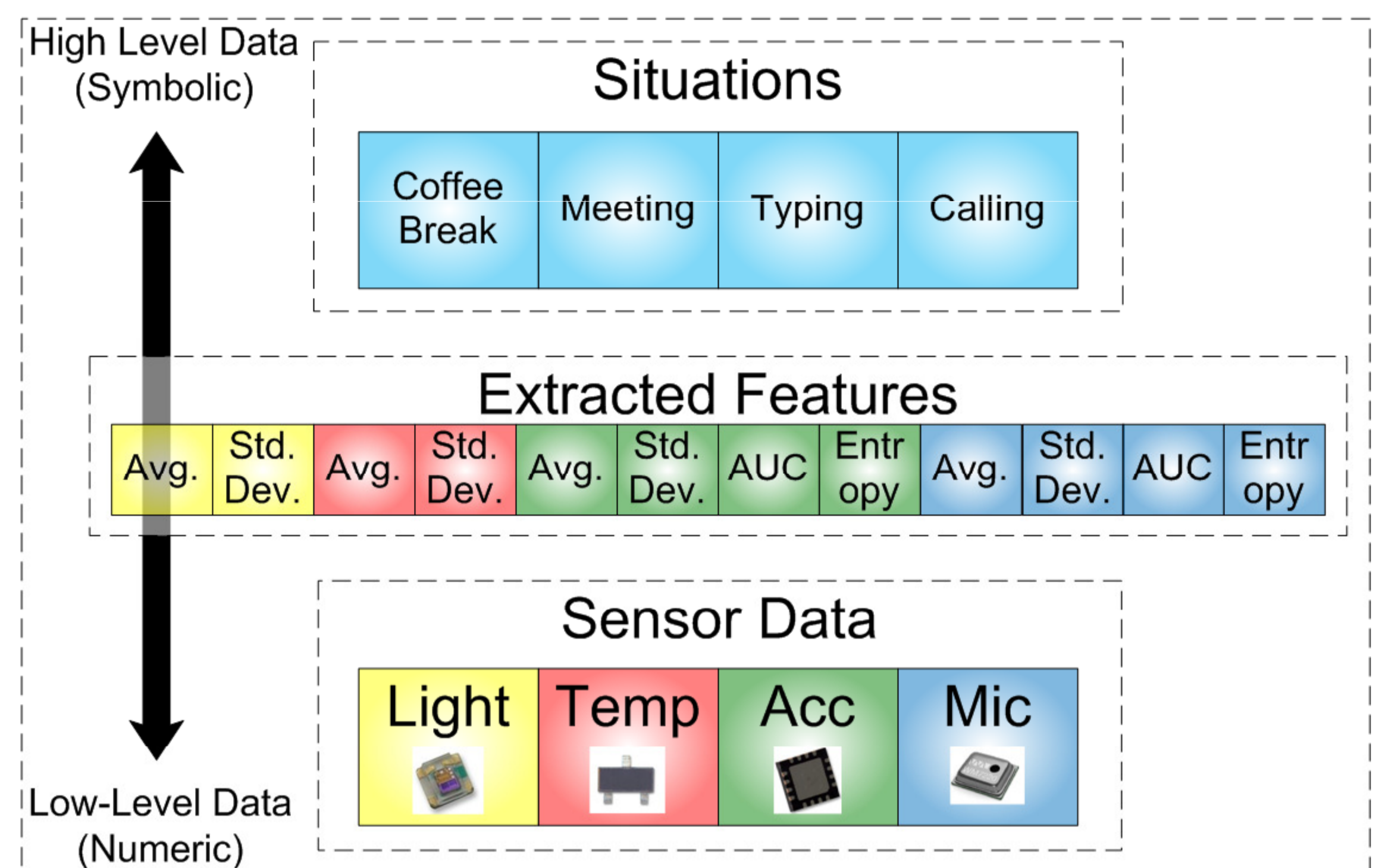


Fig. 1: Data Hierarchy for Recognition in Embedded Systems

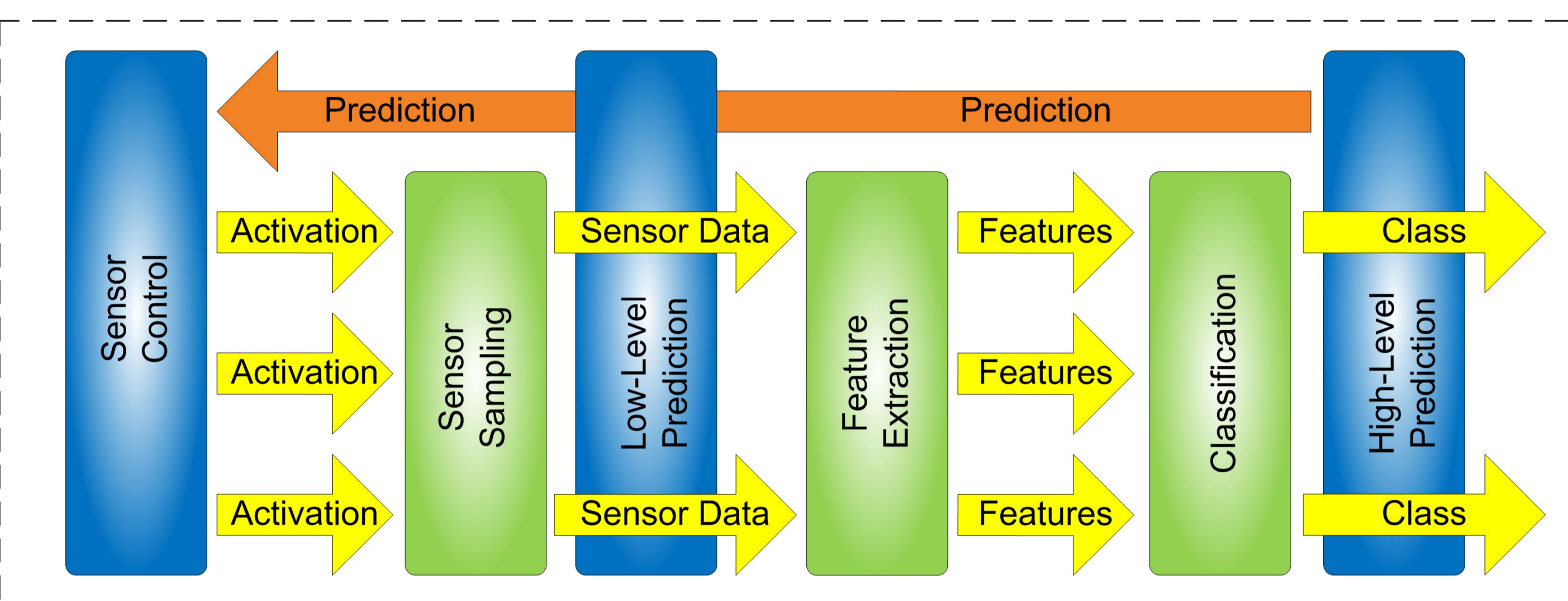


Fig. 2: Using Prediction to Control Sensor Activation

Data Abstraction Level:

- High-Level prediction of symbolic context data using a **Markov model**
- Low-level prediction of numeric sensor data using **ARMA**
- Compare prediction methods in terms of processing cost, performance, affects of recognition error

Contextual cost of a sensor:

- Evaluate the cost of each feature by turning it off and reclassifying
- Creates a **cost-weighted mapping** of classes onto features
- Evaluate cost of each sensor by summing feature costs from that sensor

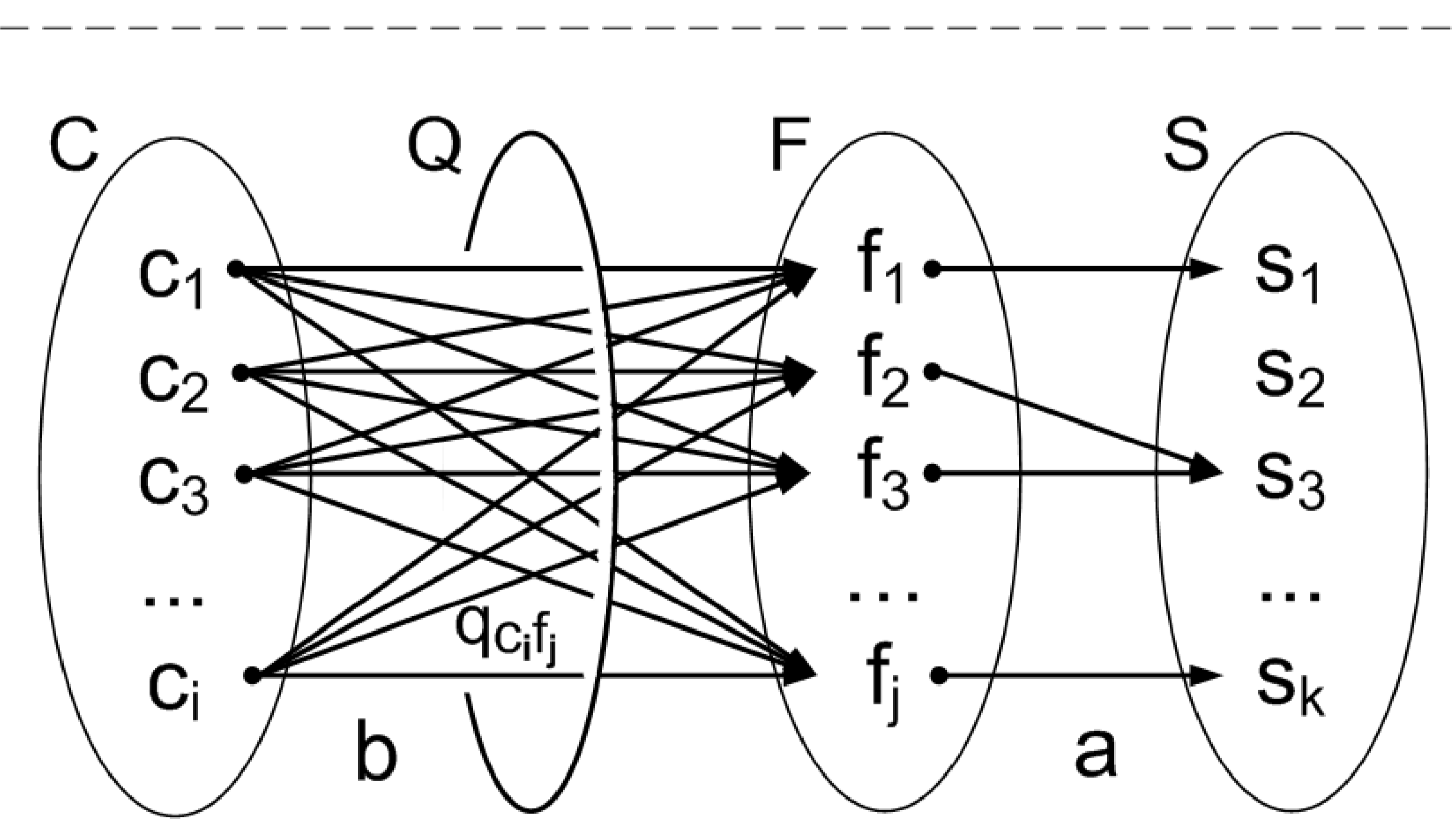


Fig. 4: (C)lass, (F)eature, (S)ensor Mappings (a,b) and Weights (Q)

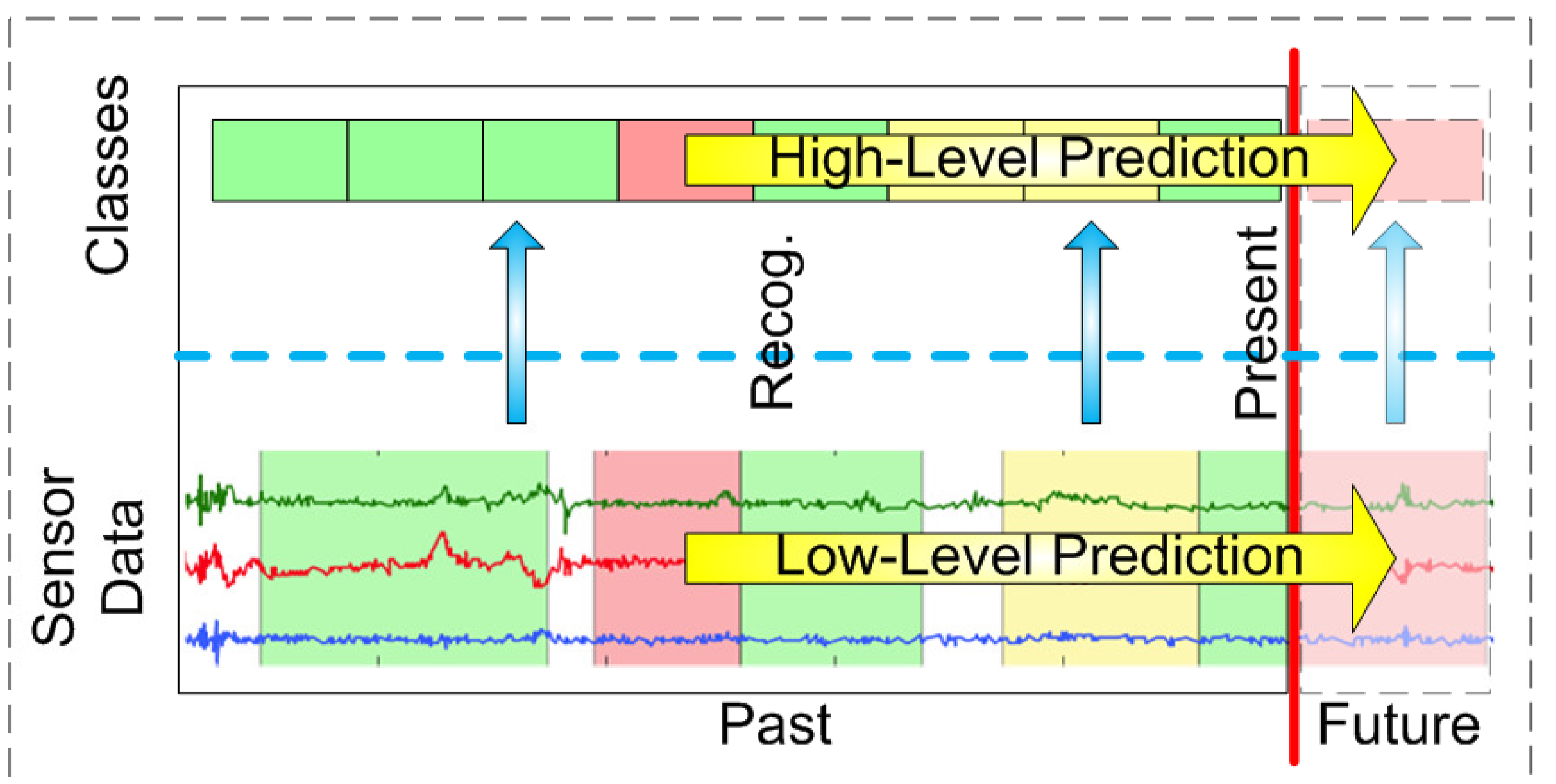


Fig. 3: High-Level and Low-Level Approaches to Context Prediction

Algorithm:

1. Predict probable future contexts using history
2. Turn on sensors necessary to recognize them
3. Acquire sensor data using selected sensors
4. Perform recognition
5. Repeat