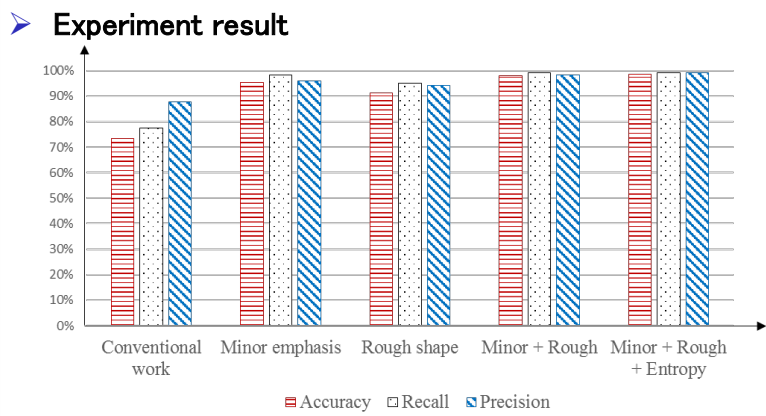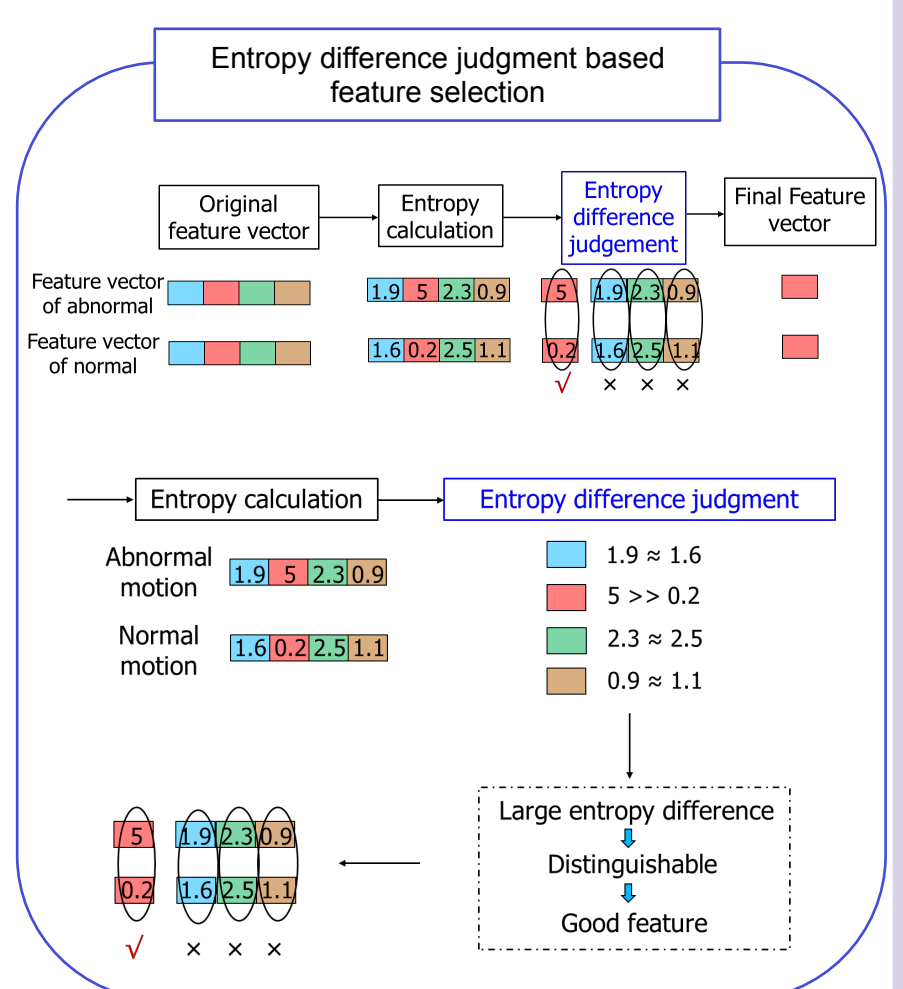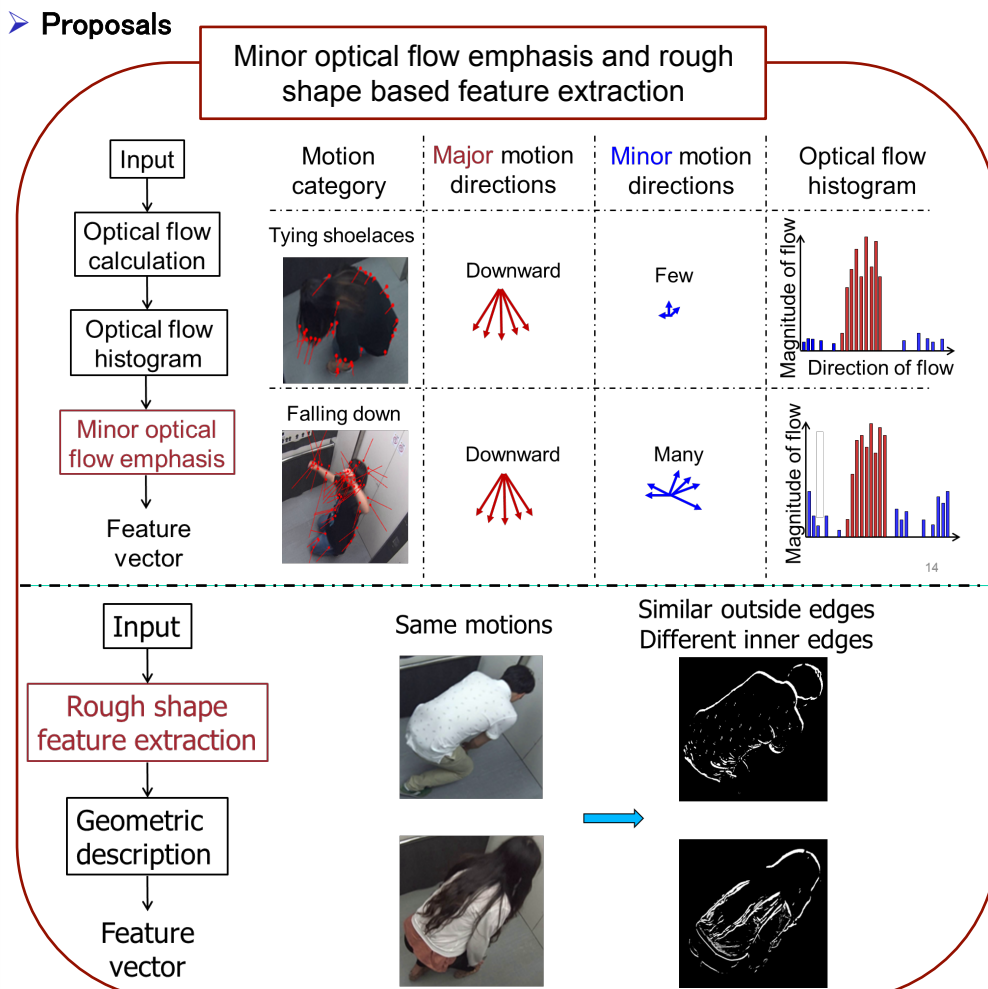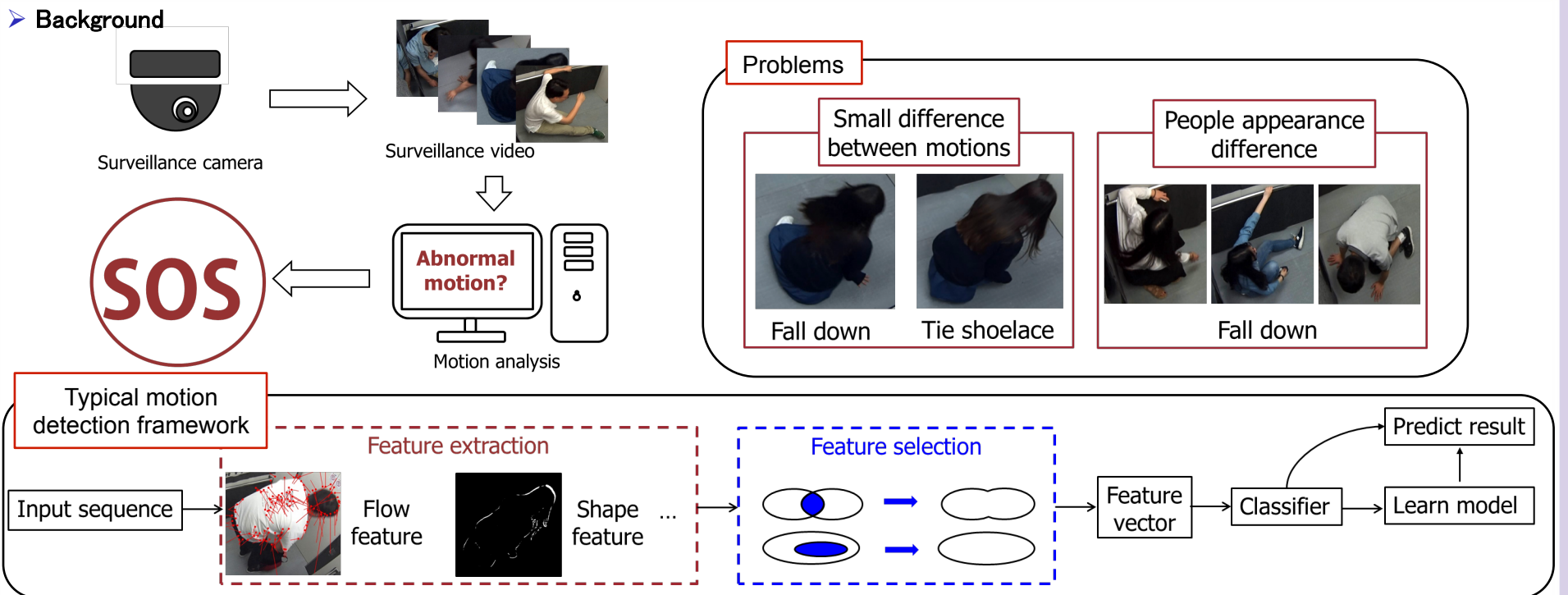# Minor Optical Flow Emphasis and Entropy Difference Judgment Based Feature Extraction for Abnormal Motion Detection in Elevator Surveillance System

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Background

Surveillance camera → Surveillance video ⇒ Motion analysis → Abnormal motion? → SOS

Problems

Small difference between motions: Fall down, Tie shoelace

People appearance difference: Fall down

Typical motion detection framework

Input sequence → **Feature extraction** (Flow feature, Shape feature ...) → **Feature selection** → Feature vector → Classifier → Learn model → Predict result

Proposals

Minor optical flow emphasis and rough shape based feature extraction

Input → Optical flow calculation → Optical flow histogram → Minor optical flow emphasis → Feature vector

Motion category	Major motion directions	Minor motion directions	Optical flow histogram
Tying shoelaces	Downward	Few	Magnitude of flow / Direction of flow
Falling down	Downward	Many	Magnitude of flow

Input → Rough shape feature extraction → Geometric description → Feature vector

Same motions — Similar outside edges Different inner edges

Entropy difference judgment based feature selection

Original feature vector → Entropy calculation → **Entropy difference judgment** → Final Feature vector

Feature vector of abnormal: 1.9 5 2.3 0.9
Feature vector of normal: 1.6 0.2 2.5 1.1

Entropy difference judgment: [5 / 0.2] √, [1.9 / 1.6] ×, [2.3 / 2.5] ×, [0.9 / 1.1] ×

Entropy calculation → Entropy difference judgment

Abnormal motion: 1.9 5 2.3 0.9
Normal motion: 1.6 0.2 2.5 1.1

- 1.9 ≈ 1.6
- 5 >> 0.2
- 2.3 ≈ 2.5
- 0.9 ≈ 1.1

Large entropy difference ⇩ Distinguishable ⇩ Good feature

[5 / 0.2] √, [1.9 / 1.6] ×, [2.3 / 2.5] ×, [0.9 / 1.1] ×

Experiment result

AUC(Conventional work)=0.7801
AUC(Minor + Rough)=0.9867
AUC(Minor + Rough + Entropy)=0.9913

Categories: Conventional work, Minor emphasis, Rough shape, Minor + Rough, Minor + Rough + Entropy
Legend: Accuracy, Recall, Precision

Conclusion

The proposed method runs on the elevator surveillance sequences detects abnormal motion with an accuracy of 98.67%, gaining 25.34% improvement compared with conventional work.