Find the Five Differences

We humans are quite adapt at identifying things that do not conform to our perception of established norms. To experience this, study the images below. Use the image on the left to form a baseline of normality. Then carefully process the image on the right to identify all five differences. You might call this a game, but if the task were completed by a computer it would be called **unlabeled anomaly detection using semi-supervised learning**.

Towards Secure Intelligent Buildings

Anomaly-based detection is originating from network intrusion detection systems. These systems follow an approach similar to the one you used on the images above to classify network traffic as either normal or anomalous.

As technology increasingly is being integrated directly into our homes and houses, the base for intelligent building environments are growing rapidly.

We propose to utilize the advances from network intrusion detection systems in intelligent buildings by implementing anomaly-based detection.

Surveillance cameras are used to monitor the flow of people in the building, the patterns in movement and the habits of the inhabitants.

This data is processed to establish the baseline of normal activity. Any deviations from this baseline could indicate illegitimate access or hostile reconnaissance.

We are implementing anomaly detection using live sensor information from a public building. **We conjecture that implementing anomaly detection enhances the security of the intelligent building.**

Working with live data motivates an unsupervised and unlabeled learning approach. To achieve this, artificial intelligence techniques, to analyze the sensor information, are being explored.

Unlabeled anomaly detection systems are based on the rationale that normal activity in the data greatly exceeds the potential malicious activity. Another assumption is that the attack patterns are distinguishable from normal patterns in a suitable feature space. This paradigm is known as one-class classification.

These two assumptions are valid for traffic in networks, and **we conjecture they are equally valid for traffic in smart environments.**

Graphs in Computer Graphics, Image and Signal Analysis **Rutsker, Bornholm, Denmark** **Mads Ingerslew Ingwar, ming@imm.dtu.dk**