

# DATA-DRIVEN MANAGEMENT OF FIRE INCIDENTS

**Prof. Dr. Steven Verstockt**

# STEVEN VERSTOCKT?

Master's degree in informatics from Ghent University (2003)

Ph.D. on multi-modal video fire analysis at the Multimedia Lab (ELIS – Ugent)

Since september 2014 – tenure track professorship in Multimedia at IDLab

<http://www.ugent.be/ea/idlab>  
<http://idlab.technology/>

Current research focuses on **multimodal data processing**,  
*filtering, classification, enrichment,*  
*mapping and visualization.*

## IDLAB



Distributing Intelligence in IoT



Machine Learning & Data Mining



Semantic Intelligence



Multimedia Processing

**300**

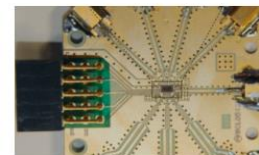
Internet experts and data scientists

IDLab focuses its research on *internet technologies* and *data science*. We develop technologies outperforming current solutions for communication subsystems, high speed and low power networking, distributed computing and multimedia processing, machine learning, artificial intelligence and web semantics.

**+500**

Collaborations with innovative industry

IDLab collaborates with many universities and research centres worldwide and jointly develops advanced technologies with industry (R&D centers from international companies, Flanders' top innovating large companies and SMEs, as well as numerous ambitious startups).



Electromagnetics & high-frequency circuit design



Wireless Networking



Fixed Networking



Cloud & Big Data Infrastructures

# VIDEO FIRE ANALYSIS (VFA) RESEARCH @ IDLAB

## Multi-modal video analysis for early fire detection (2011)

Author

Steven Verstockt (UGent)

Promoter

Rik Van de Walle (UGent) , Sofie Van Hoecke (UGent) and Bart Merci (UGent)

## Multi-modal Data Fusion For Spatio-Temporal Fire Behavior Analysis (2018)

Author

Florian Vandecasteele (UGent)

Promoter

Steven Verstockt (UGent) and Bart Merci (UGent)

Master theses

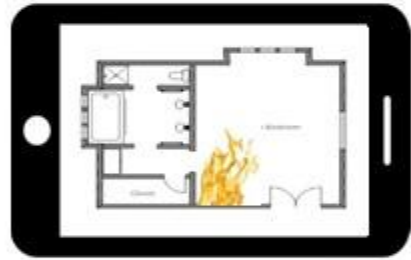
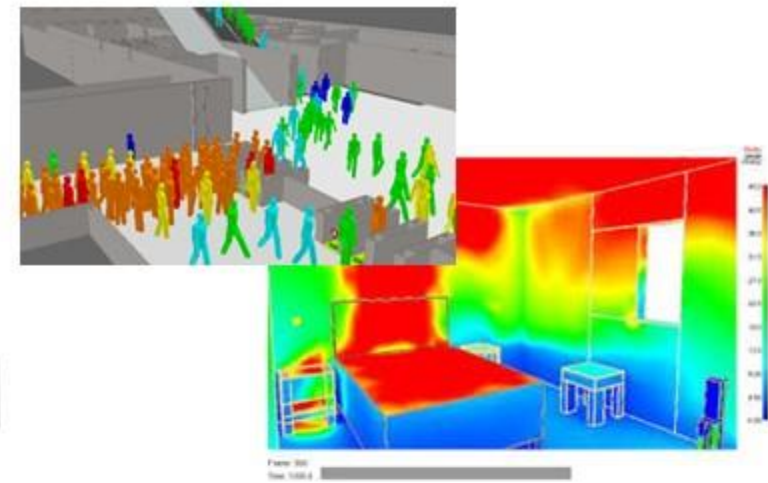
Large-scale tests

Guest lectures

Consult to industry

# CONTEXT AND PROBLEM DESCRIPTION - PRETREF





# PRETREF research on video fire analysis

<http://www.pretref.ugent.be/>

Starting point for new FSE course

Use of other sensor data?

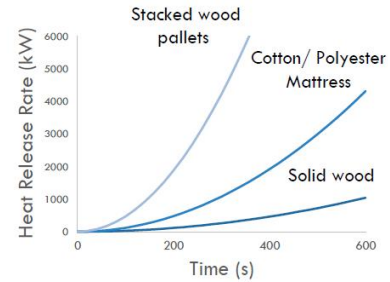
➔ second use of data

# ROOM CONFIGURATION UNDERSTANDING

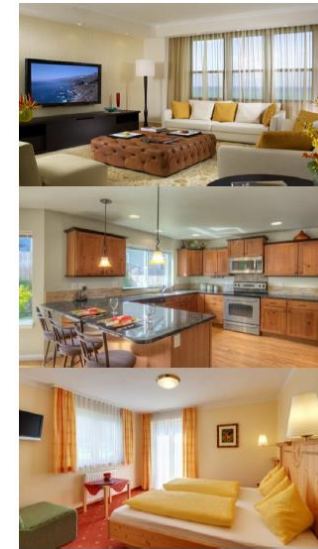


Expectation

Reality



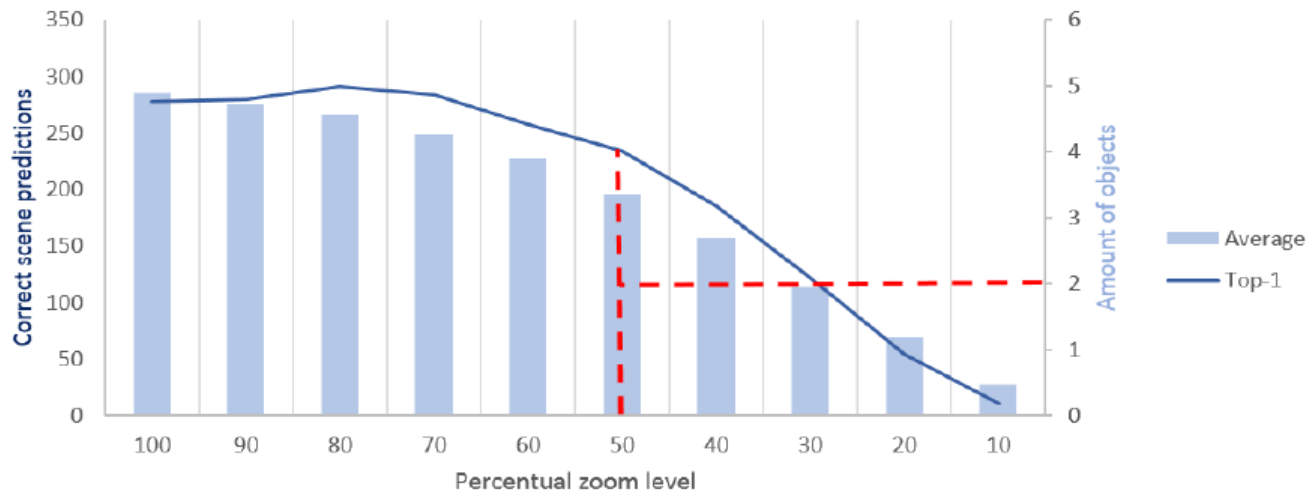
Fire growth?



Livingroom: 58%, Parlor: 40%

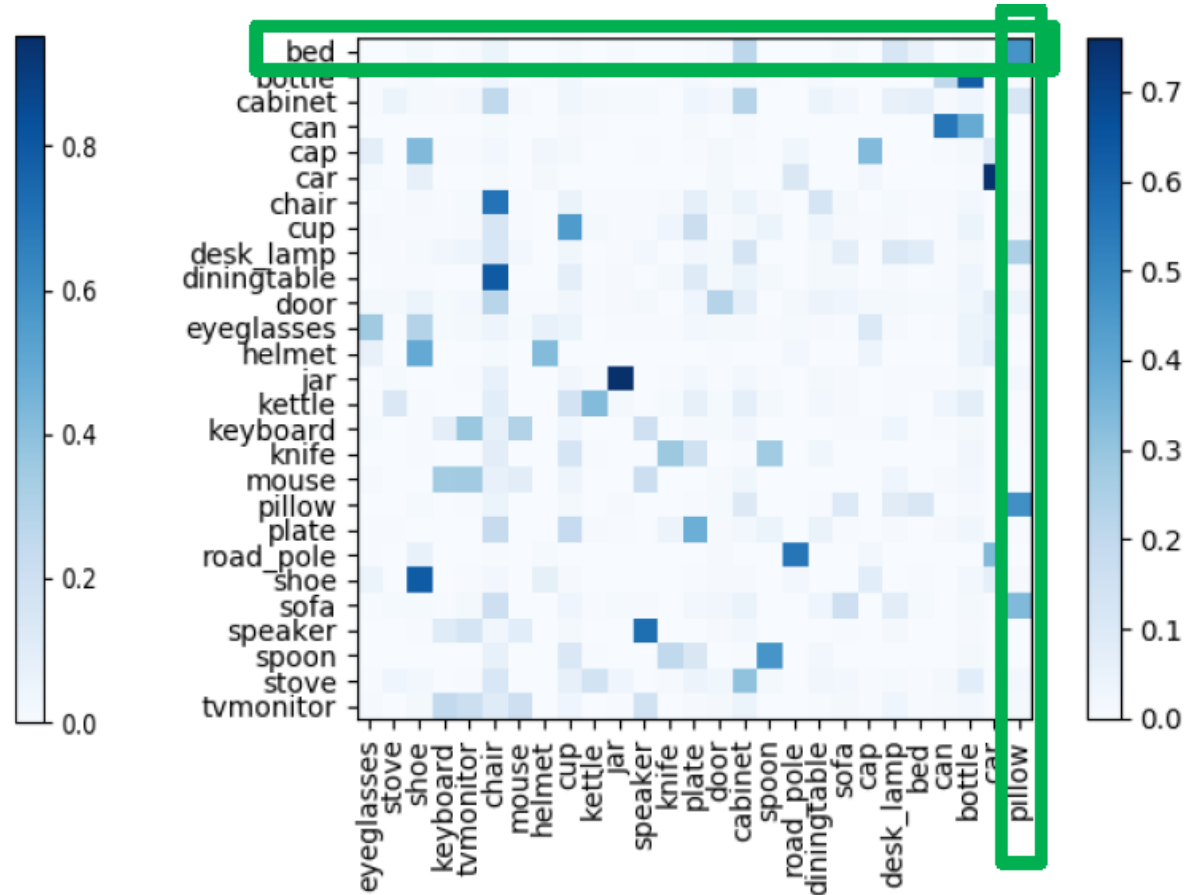
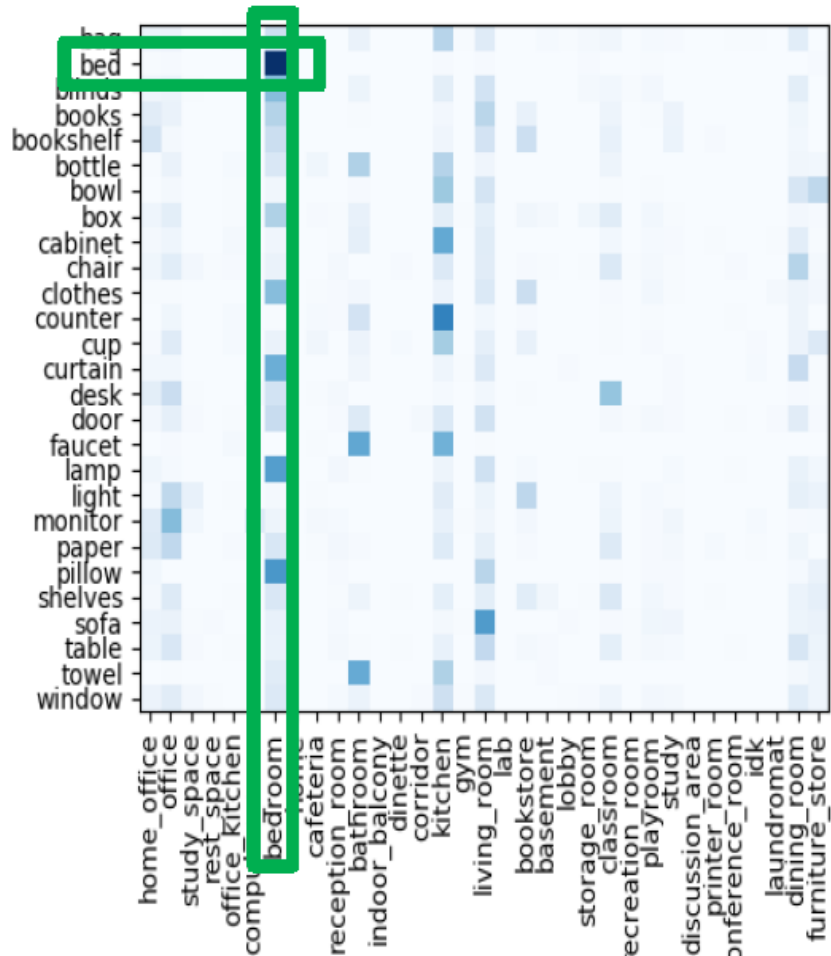
Kitchen: 60%, Kitchenette: 39%

Hotel room: 85%, Bedroom: 10%

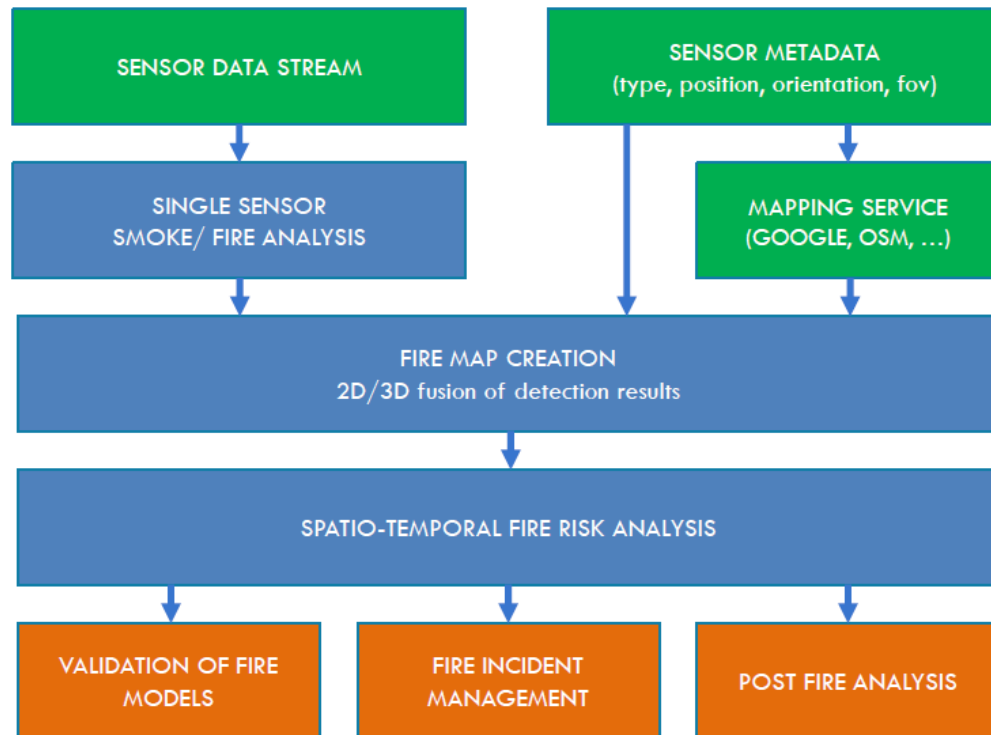


TRANSFER LEARNING – SCENE PREDICTION

# ROOM CONFIGURATION UNDERSTANDING



# FIREGIS FRAMEWORK

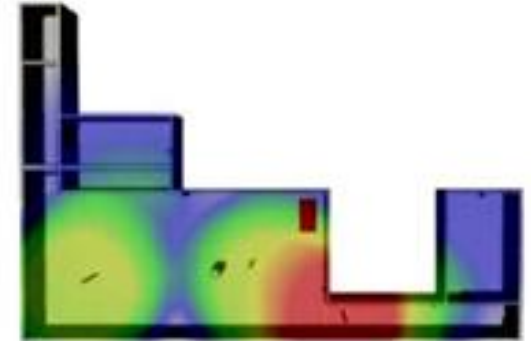


Input data / metadata  
**multi-sensor, multi-modal**

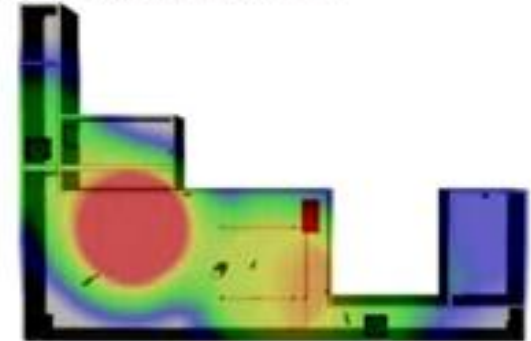
**Spatio-temporal**  
smoke and fire analysis

Validation and visualization

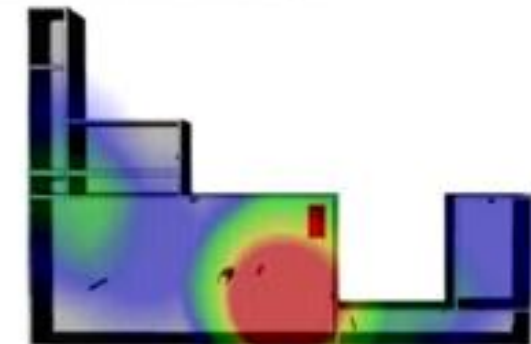
null experiment



smoke extraction and sprinkler



smoke and fire resistant doors





# VIDEO SUMMARIZATION



Drones



Handheld TIC

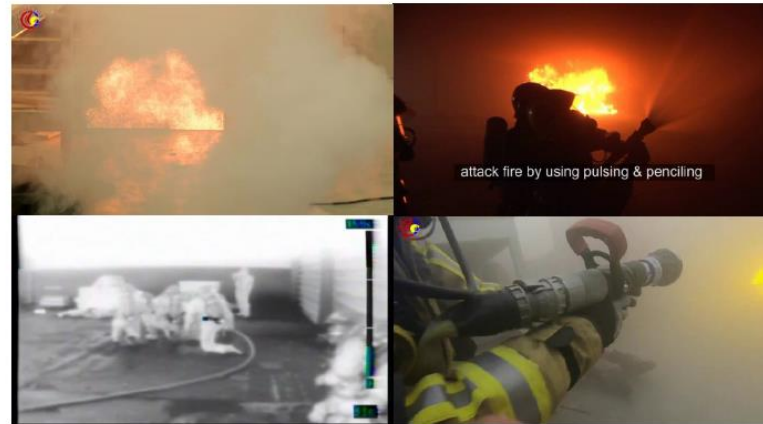


CCTV



Bodycam

Input



Output

Video source: brandweerzone centrum

Find all scenes where firefighters attack the fire?

## SIMILARITY CLUSTERING

Cluster 1



Cluster 2



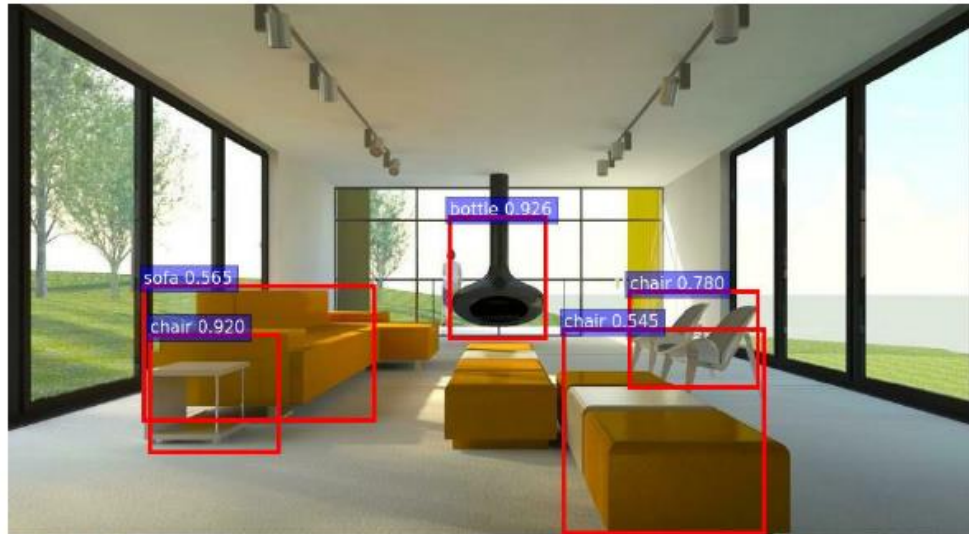
Cluster 3



Video source: brandweerzone centrum

# FUTURE RESEARCH

## IMAGE AND BIM ALIGNMENT: OBJECT BASED LOCATION RETRIEVAL



Predictions:

- **Type of environment:** indoor
- **Semantic categories:** parlor:0.44, living\_room:0.17, lobby:0.10, waiting\_room:0.06, veranda:0.06
- **SUN scene attributes:** enclosedarea, man-made, glass, naturallight, reading, nohorizon, glossy, soothing, wood(notpartofatree), mostlyverticalcomponents
- **Informative region for the category \*parlor\* is:**



Juni 2019 – Jan 2020

dhr. Mathieu Steenland

# THESIS RF-TECHNOLOGIES

## Design of an environmental-aware smart fire damper

Co-promotor: Prof. dr. Sofie Van Hoecke

1. Integrate and develop a new scalable fire damper mechanism that incorporates additional sensor mechanisms.
2. Design an anomaly detection algorithm for the damper sensor that takes into account environmental features.
3. Create a platform that visualizes and detects the statuses of the fire damper systems in a building through a REST-API.



Currently, the majority of systems only closes if the temperature inside the system reaches 72 degrees. Environmental parameters/characteristics (such as room occupation & functionality, moisture, surrounding temperature and fire detection parameters) are not taken into account. Furthermore, the status of the dampers installed in a building are not known in case of a fire .

dr. Melchior Schepers

# BAEKELAND FIRE ENGINEERED SOLUTIONS GHENT

## A data driven approach towards evacuation from buildings in fire conditions

Co-promotor: Prof. dr. Bart Merci, Prof. dr. Nico Van de Weghe

This PhD research aims to bring the new techniques in BIM modeling and evacuation analysis into the fire safety engineering field and aims to facilitate the coupling between evacuation exercises, BIM and CFD modeling to improve evacuation from buildings in case of a fire hazard. By coupling indoor tracking of the occupants to a dynamic BIM model, a powerful tool for the analysis of evacuation procedures will be made available. It will allow to close the feedback loop between alterations during the lifetime of a building and the envisioned fire safety strategy, originally developed during the conception of the building.

