Fachforum Brandschutz 2026

Schnittstelle zwischen abwehrendem und vorbeugendem Brandschutz

Technische Universität München
TUM School of Engineering and Design
Professorship Fire Science and Engineering
Univ.-Prof. Dr.-Ing. Claudius Hammann

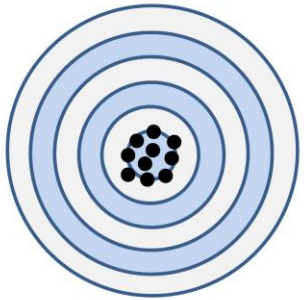
Berlin, 15. Oktober 2026



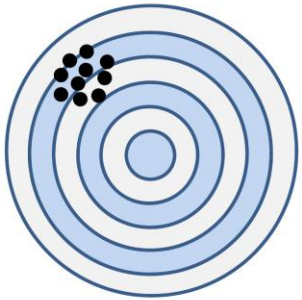
Darstellung: KI-generierte Abbildung

Brandwissenschaft und Brandingenieurwesen:

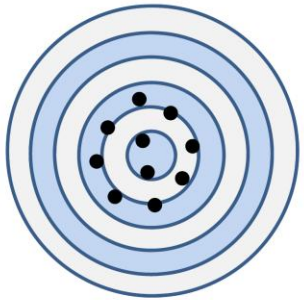
Eine nicht-exakte Wissenschaft?



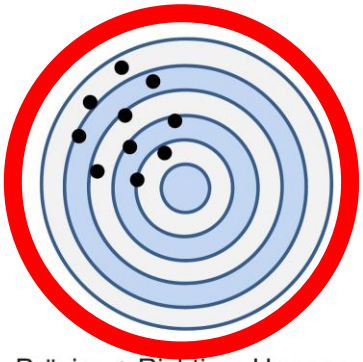
Präzise + Richtig = Sehr genau



Präzise + ~~Richtig~~ = Ungenau

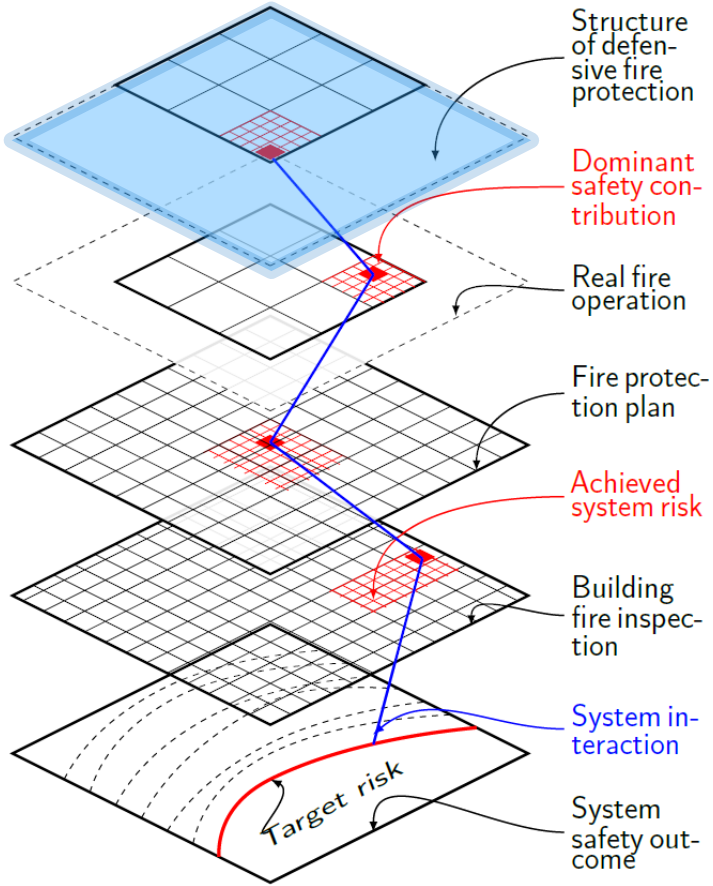


~~Präzise~~ + Richtig = Genau



~~Präzise~~ + ~~Richtig~~ = Ungenau

Einflussfaktoren (Abwehrender Brandschutz)









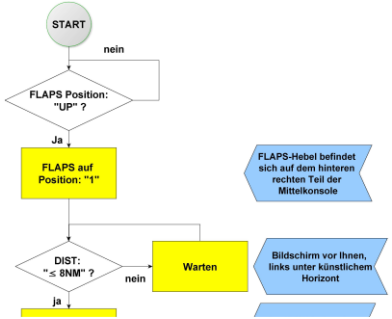


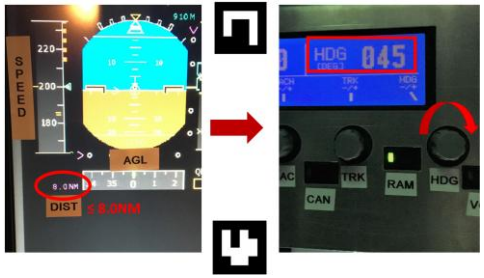
Evidenzbasierte Handlungsformen







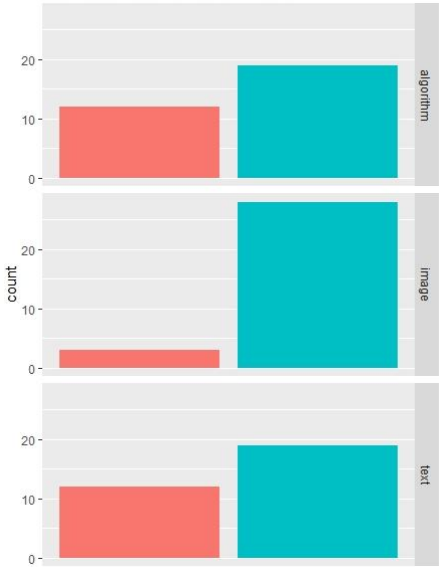


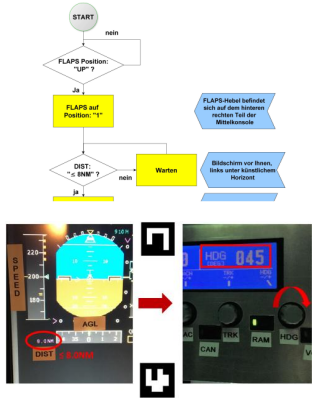


Initialisierungszustand	Auszuführende Handlung
1. **FLAPS** (Hebel Mittelkonsole hinten rechts) auf Position: **„UP“**	**FLAPS** auf Position: **„1“**
2. **DIST** (Bildschirm vor Ihnen, links unter künstlichem Horizont) zeigt: **„≤ 8.0NM“**	**HDG**-Regler (mittiger Frontbereich) auf: **„45“**
3. **HDG-Regler auf: „45“**	**SPD**-Regler (mittiger Frontbereich) auf: **„180“**
4. **DIST** (Bildschirm vor Ihnen, links unter künstlichem Horizont) zeigt: **„≤ 7.0NM“**	**HDG**-Regler auf: **„83“**

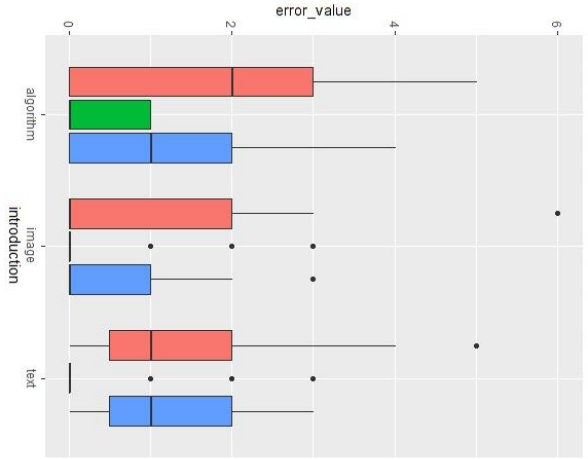
Hammann C, Krause C, Feldhütter A. Evaluation of algorithmic, textual and pictorial forms of representation of standard operating procedures for error reduction in complex systems. Heliyon, 2020; 6

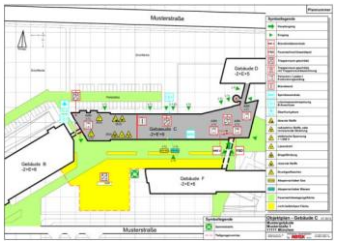
Ergebnisse





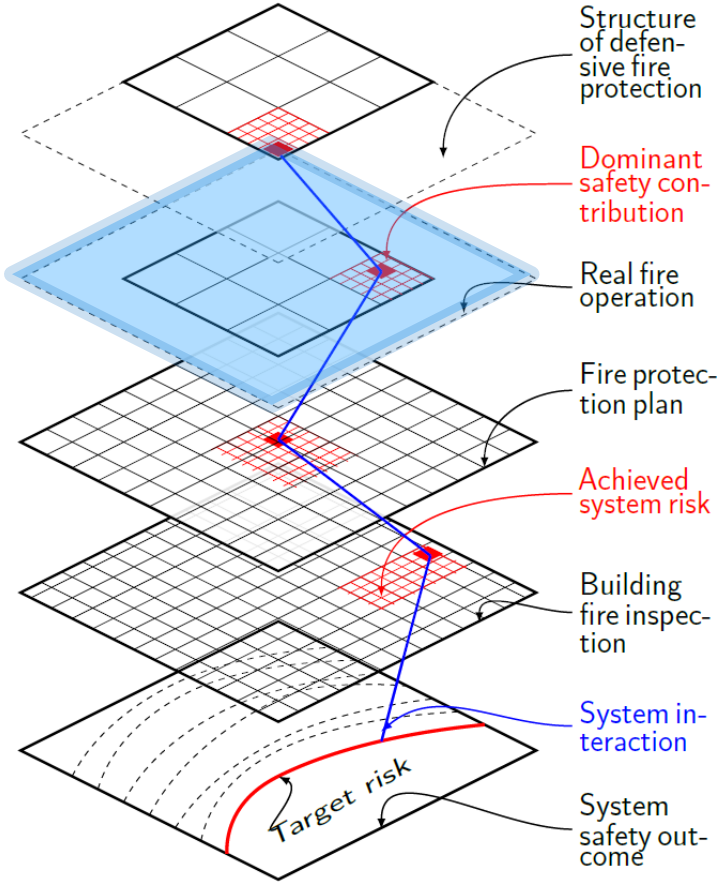
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Einflussfaktoren (Einsatzstellenbewertung)





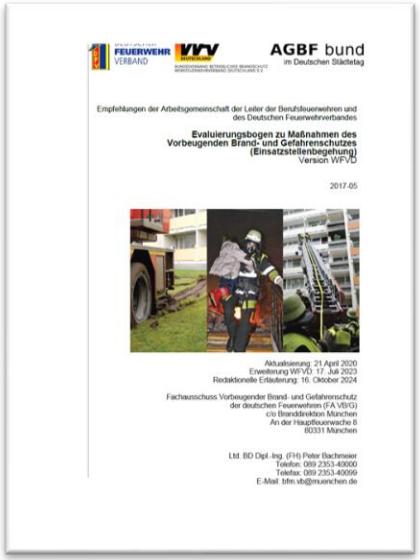


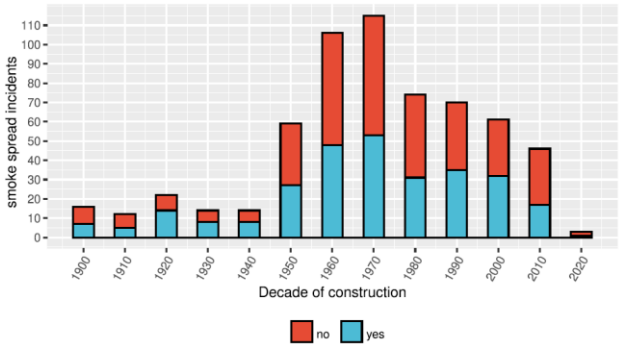




Einsatzstellenbegehung



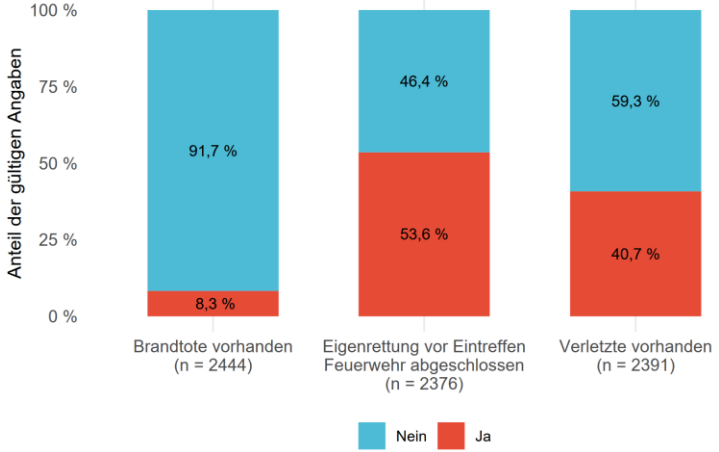


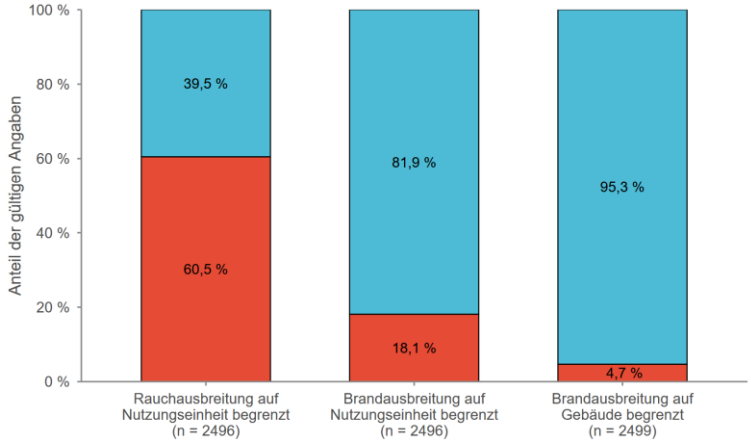


AGBF bund: Fachausschuss VB

Erkenntnisse aus 2500 signifikanten Bränden

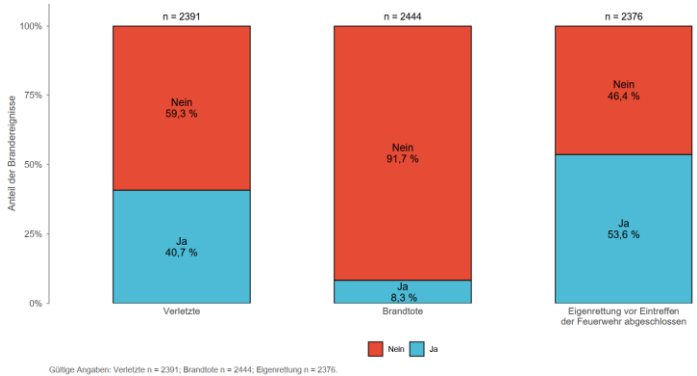


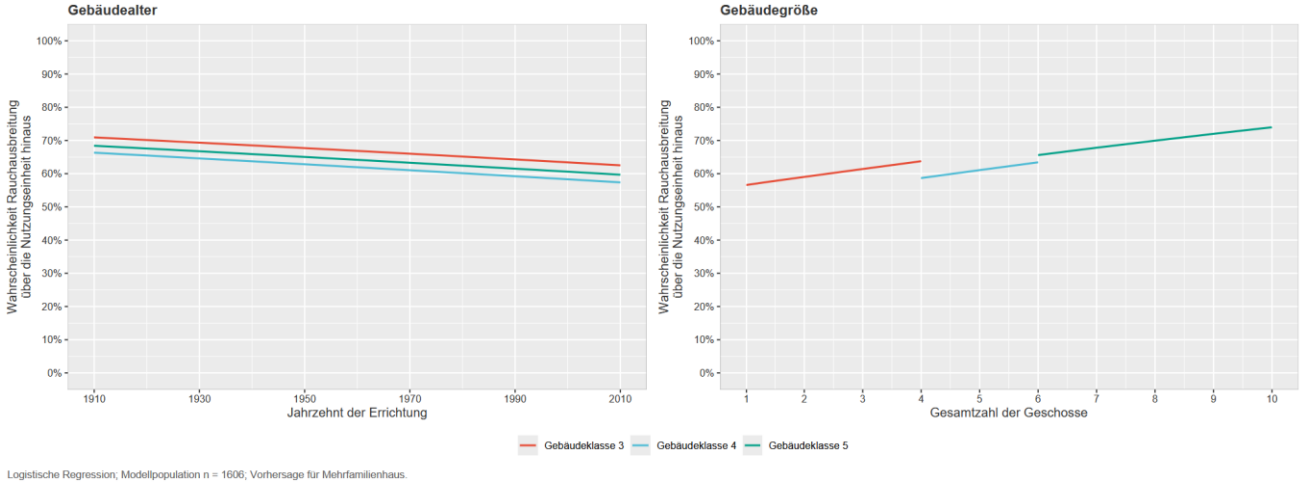




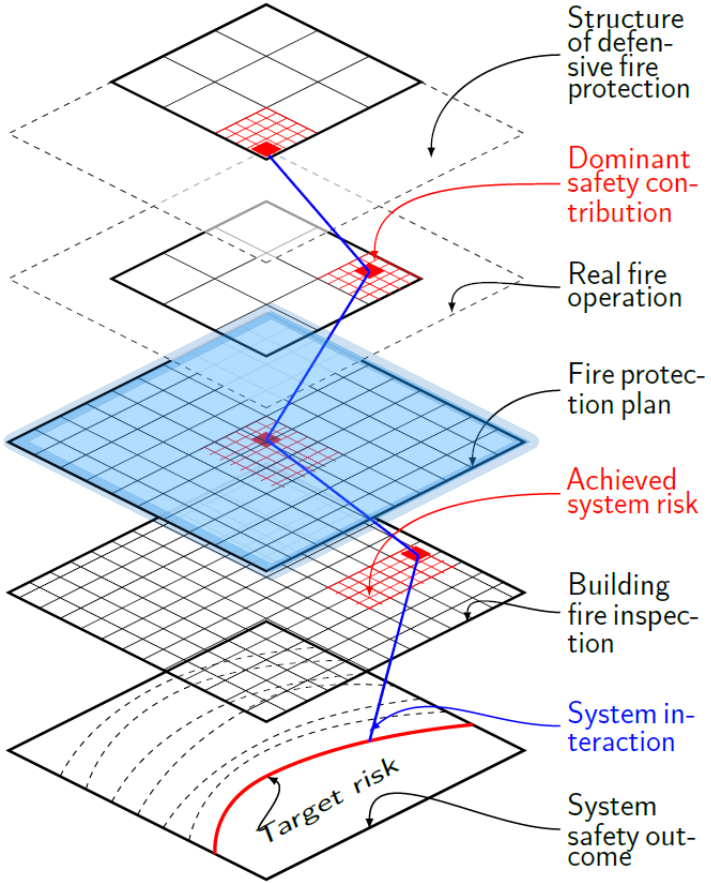


Erkenntnisse aus 2500 signifikanten Bränden





Einflussfaktoren (Brandschutzplanung)





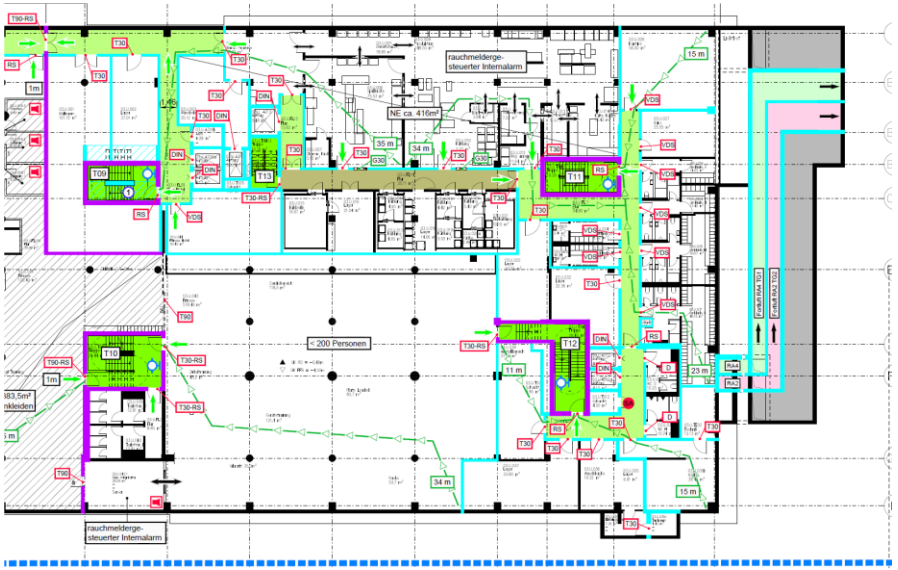




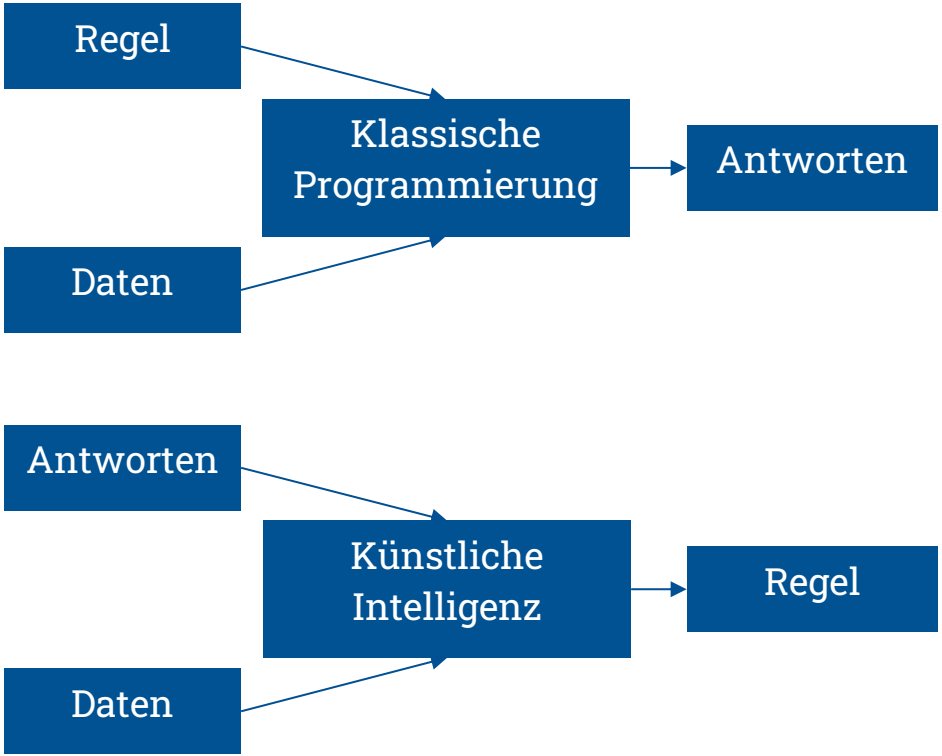


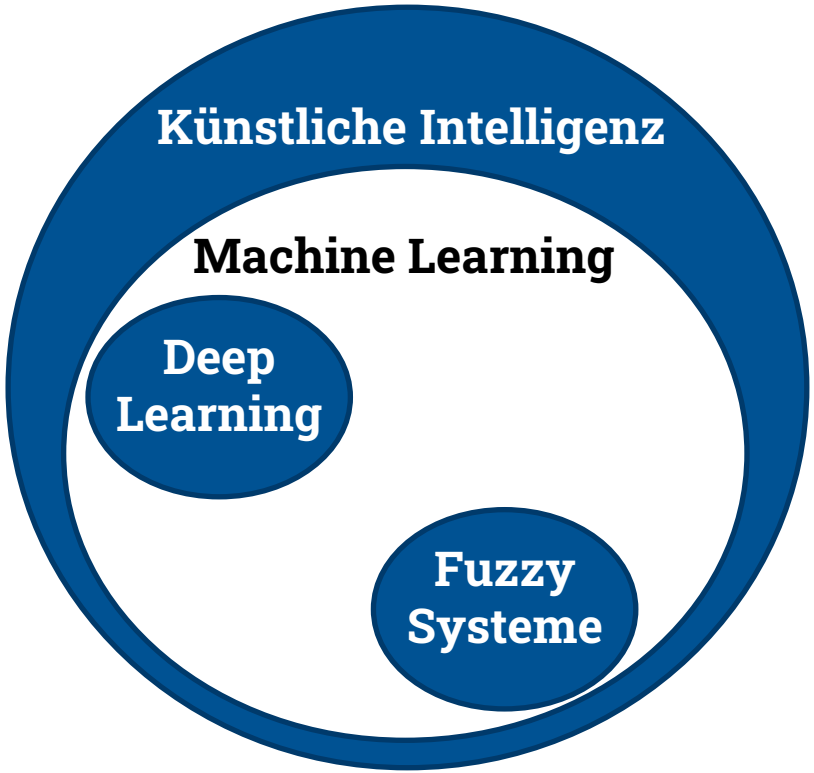
Katze vs. Brandschutznachweis



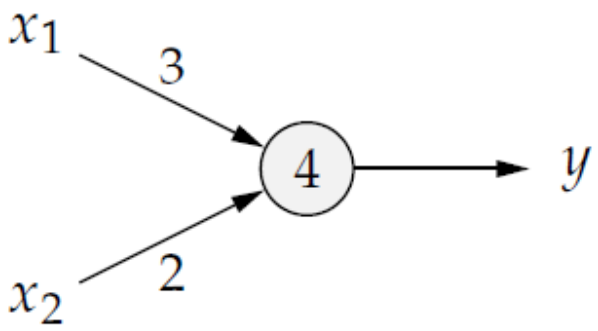


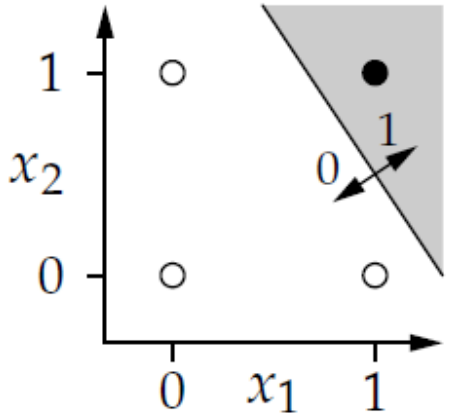
Was ist anders?





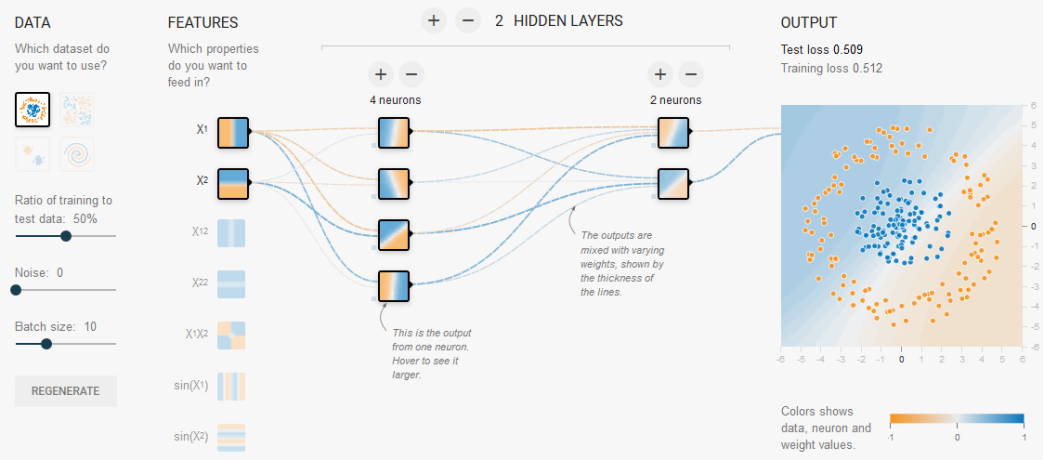
Trennung durch Schwellenwert





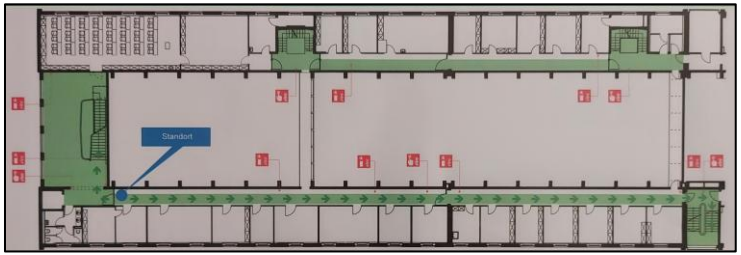
x_1	x_2	$3x_1 + 2x_2$	y
0	0	0	0
1	0	3	0
0	1	2	0
1	1	5	1

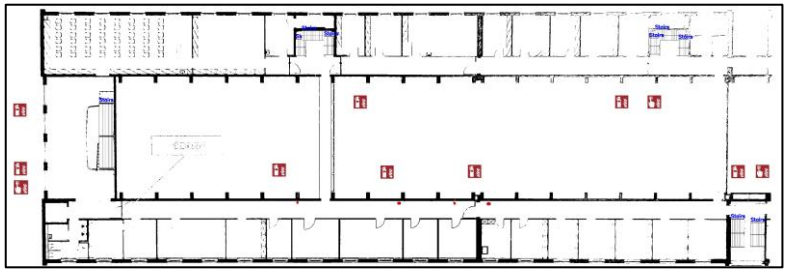
Beispiel TensorFlow



https://playground.tensorflow.org/

BeExcited: Emergancy Floor Planung





Photos of plans

Training

~80% of dataset

Validation

~20% of dataset

Setup

Flip and blur (p=50%)

Not augmented

Data Augmentation

Update network parameters

Check for overfitting

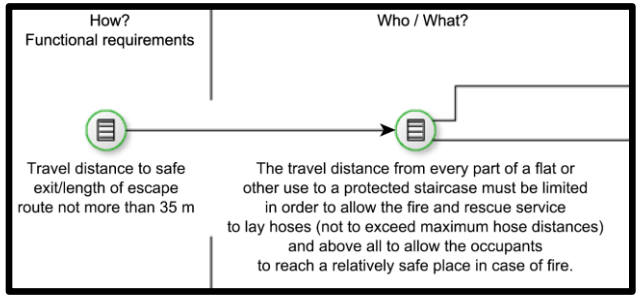
Training

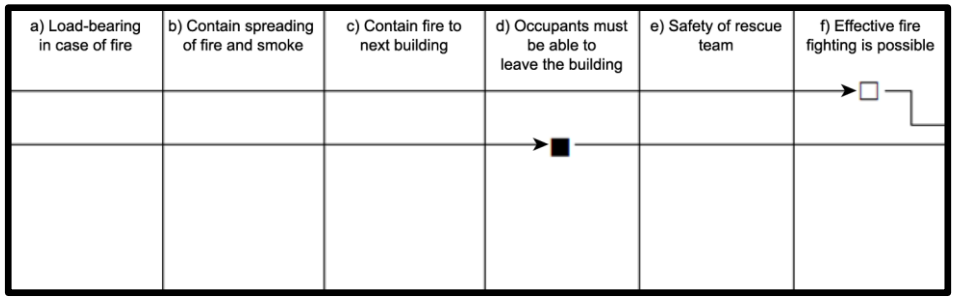
Inference

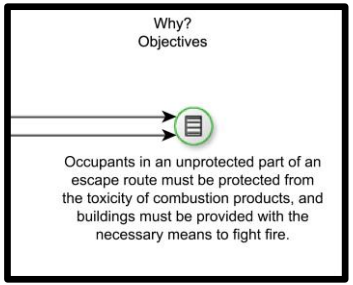
Identify unlabelled symbols

Emergency symbol-only plans

Materielle Anforderung: Schutzziel

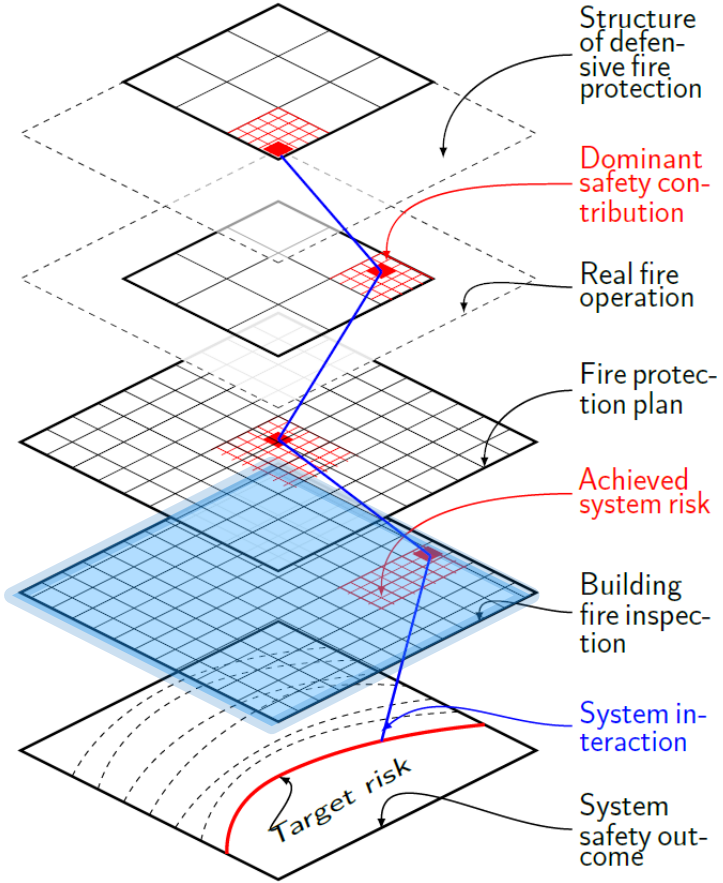






Maiworm, Björn; Göldner, Moritz; Mannl, Kilian; Hammann, Claudius (2024). Evaluating 900 significant fires in Germany: Is the prescriptive building code effective? German fire departments evaluated fire safety precautions in buildings through on-scene inspections. Fire Technology (60), 2041 – 2065.

Einflussfaktoren (Feuerbeschau)



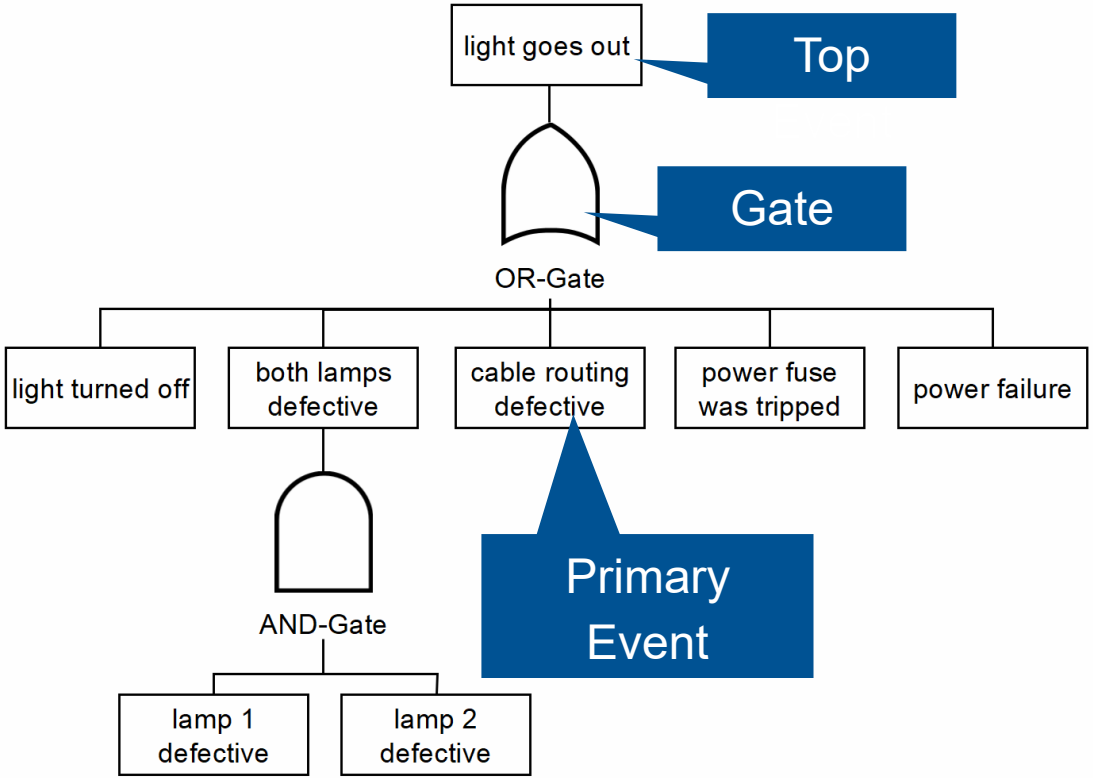








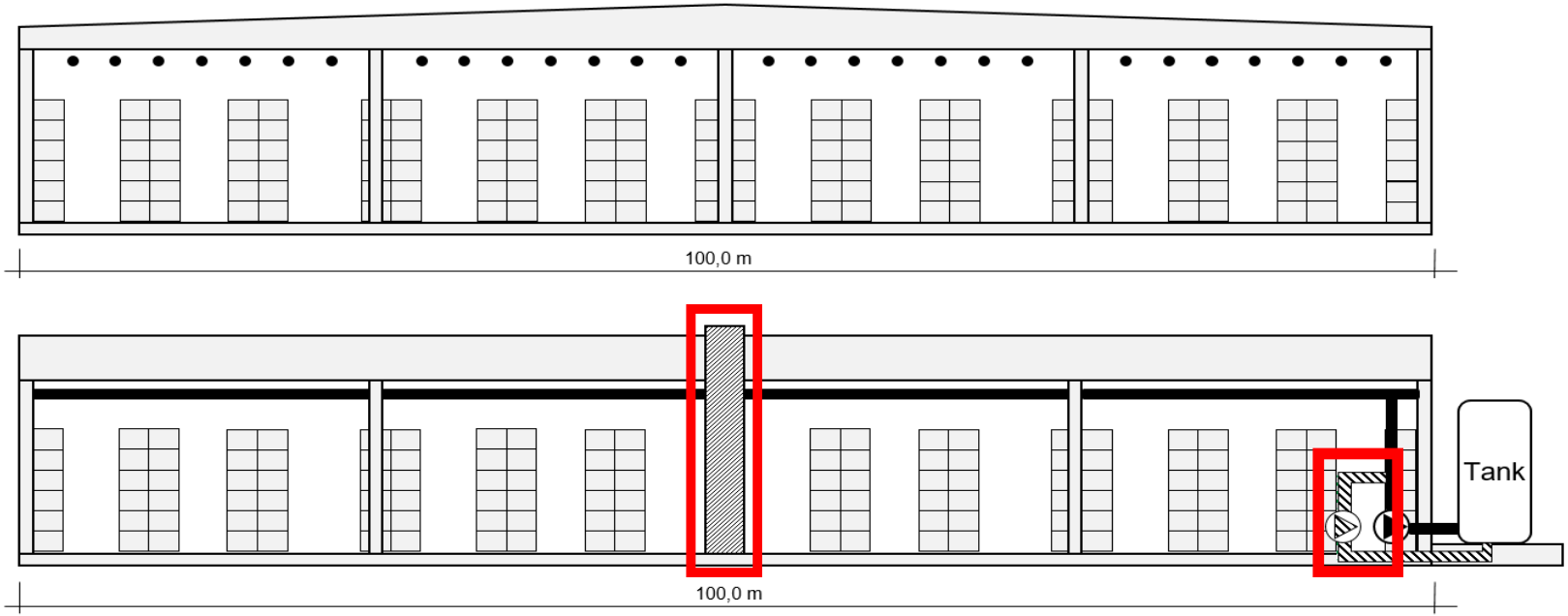
Best-Performance-Ratio (Fault-Tree-Analysis – FTA)





Die Fehlerbaumanalyse (FTA) ist eine strukturierte Methodik zur Beantwortung von Fragen, „Was kann dazu führen, dass …?“ und dabei eine systematische Analyse zu ermöglichen. Der Platzhalter „…“ steht hierbei für ein unerwünschtes Ereignis, das als TOP-Event bezeichnet wird.

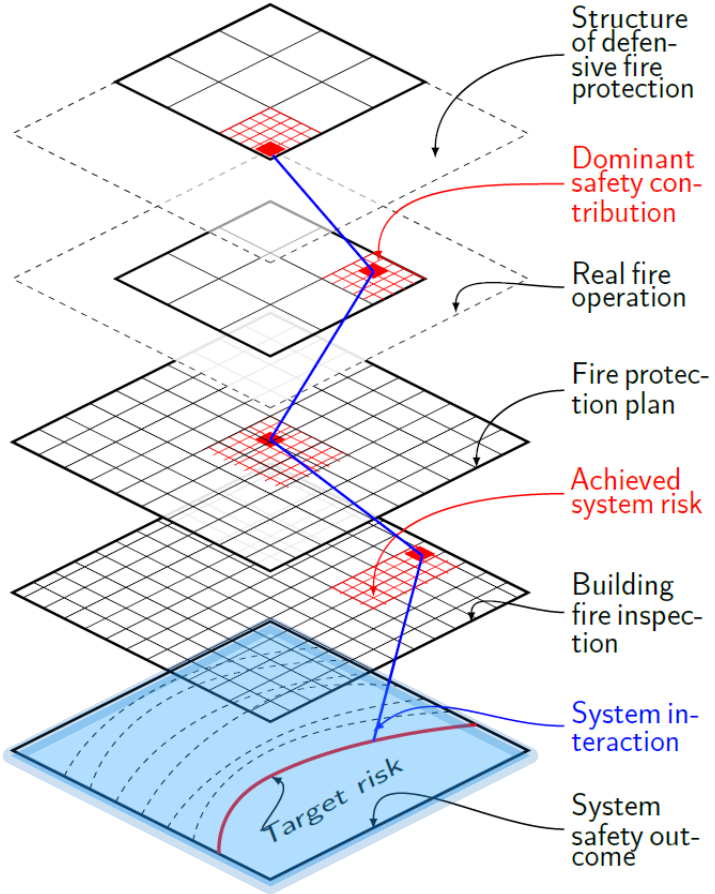
Industriehalle: Brandwand vs. SPZ



245,000 €
für eine Brandwand,
zur Trennung der Brandabschnitte

10,000 €
für eine redundante
Sprinklerpumpe

Einflussfaktoren (Zielrisiko)

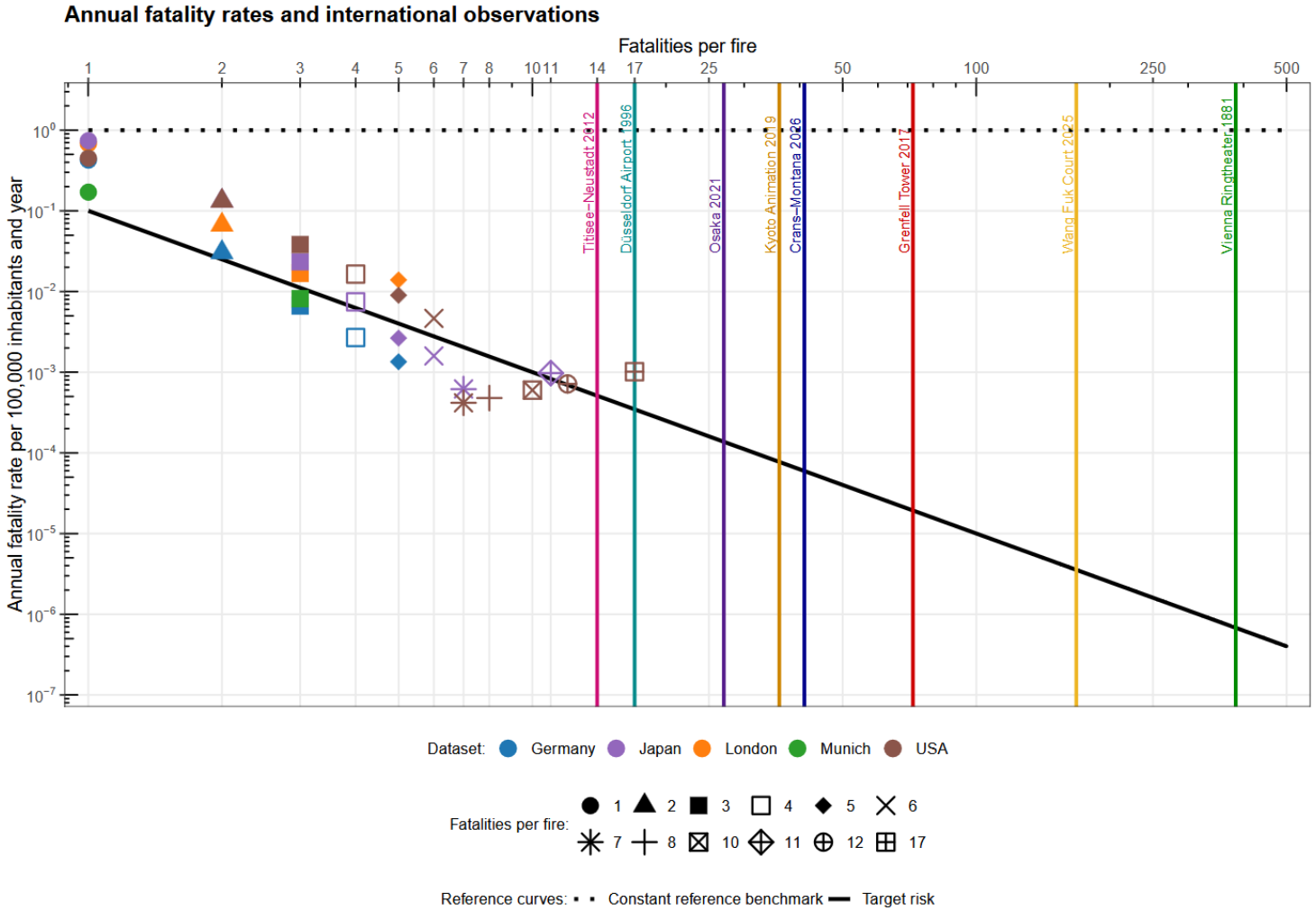


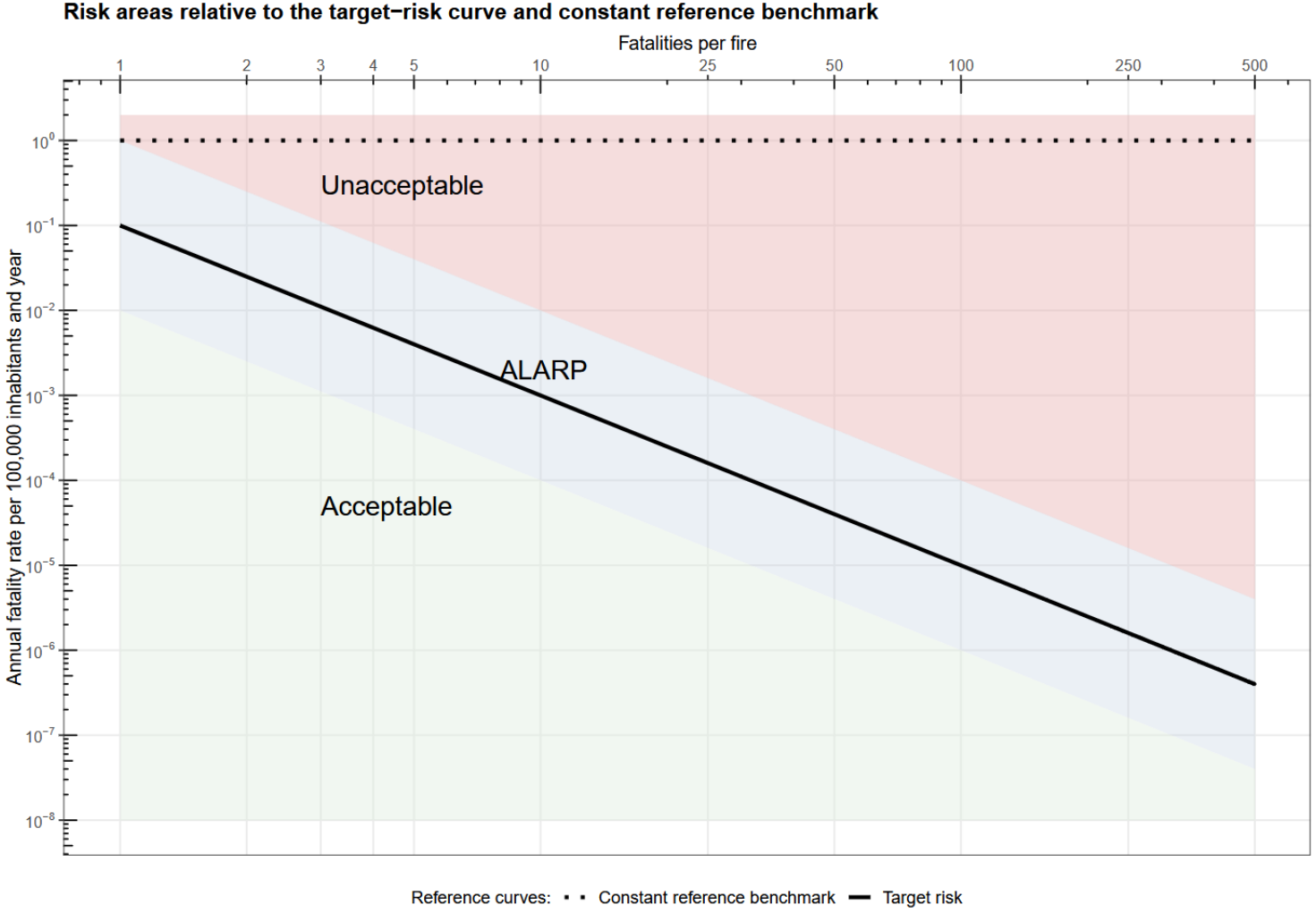









Annual fatality rates and international observations
Fatalities per fire
1
2
3
4
5
6
7
8
10
11
14
17
25
50
100
250
500
Annual fatality rate per 100,000 inhabitants and year
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
Titisee–Neustadt 2012
Düsseldorf Airport 1996
Osaka 2021
Kyoto Animation 2019
Crans–Montana 2026
Grenfell Tower 2017
Wang Fuk Court 2025
Vienna Ringtheater 1881
Dataset: Germany Japan London Munich USA
Fatalities per fire: 1 2 3 4 5 6 7 8 10 11 12 17
Reference curves: Constant reference benchmark Target risk


Risk areas relative to the target−risk curve and constant reference benchmark
Fatalities per fire
1
2
3
4
5
10
25
50
100
250
500
Annual fatality rate per 100,000 inhabitants and year
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-8}
Unacceptable
ALARP
Acceptable
Reference curves: Constant reference benchmark Target risk

Diskussion

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TUM School of Engineering and Design
Department of Civil and Environmental Engineering
Technische Universität München

