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Simulation-based modelling of UAV thermal sensing for information-driven autonomous perception

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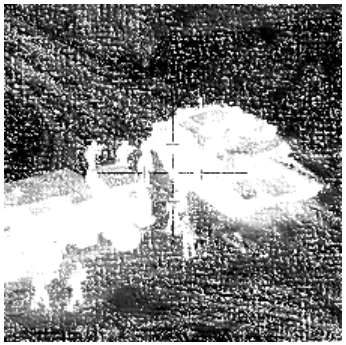
Dariusz Rodzik, PhD Eng - (dariusz.rodzik@wat.edu.pl)

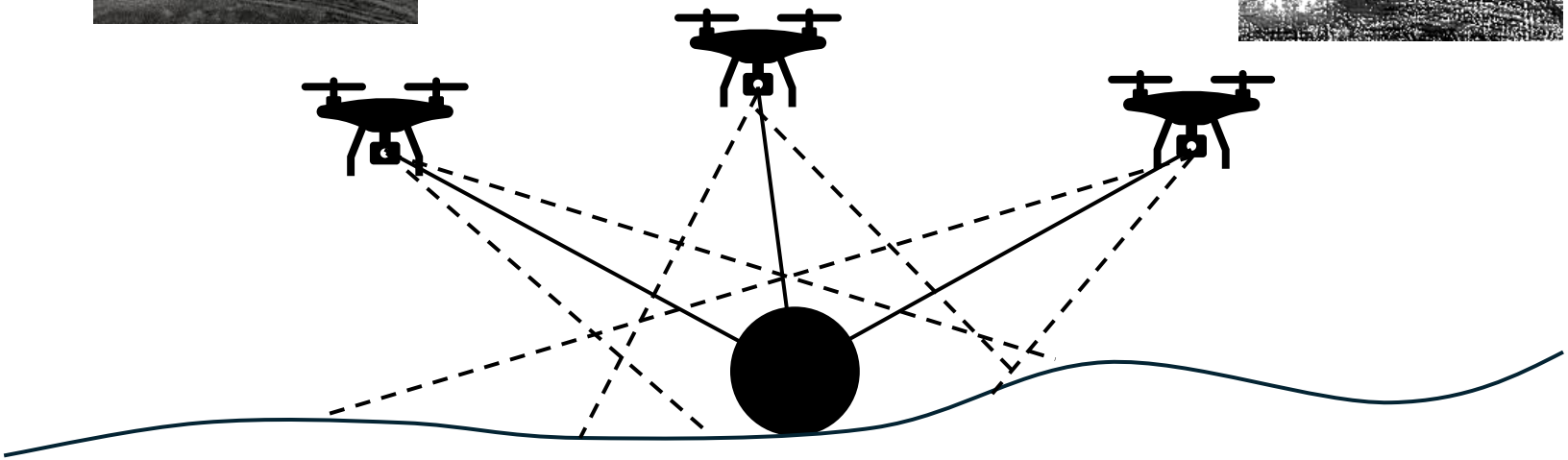
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Origin of the subject

f_1 

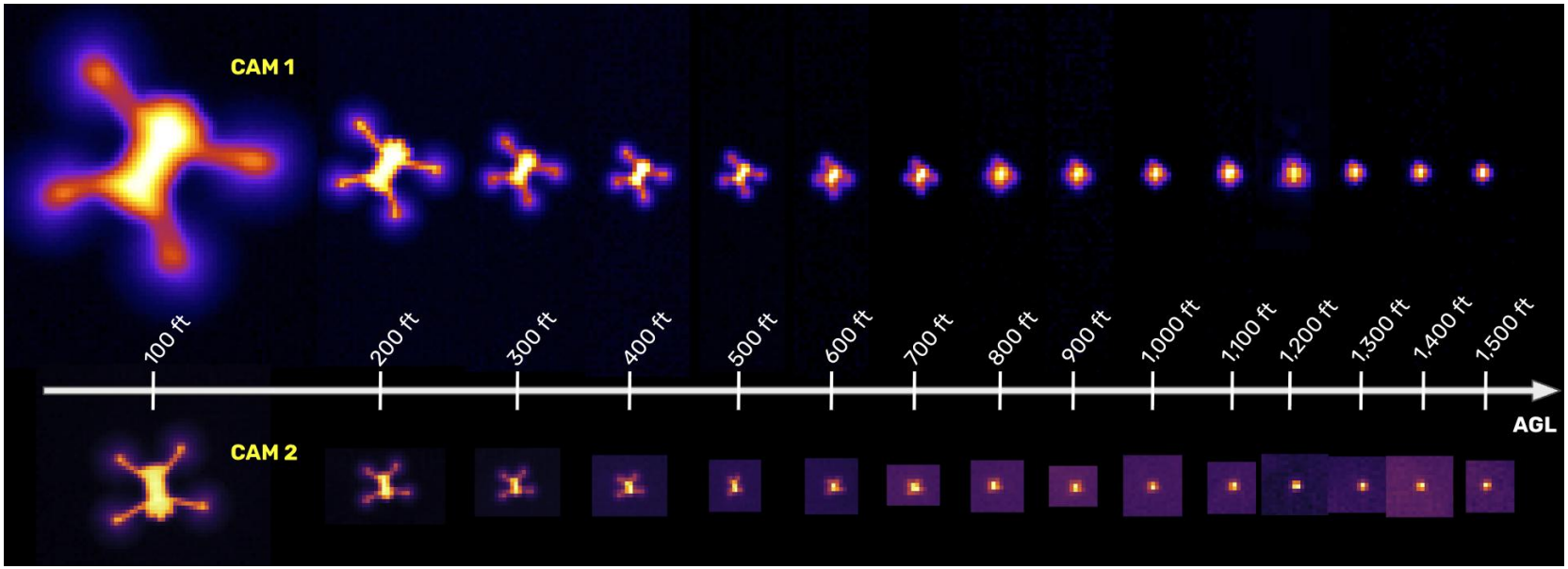
f_2 

f_3 



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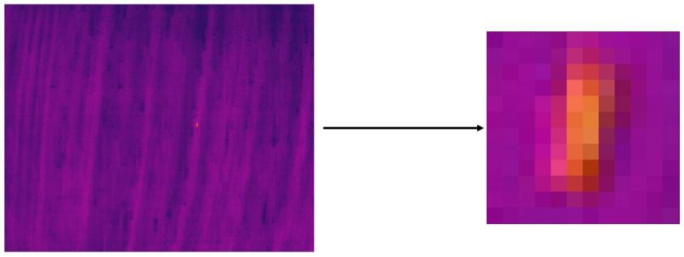
Related work



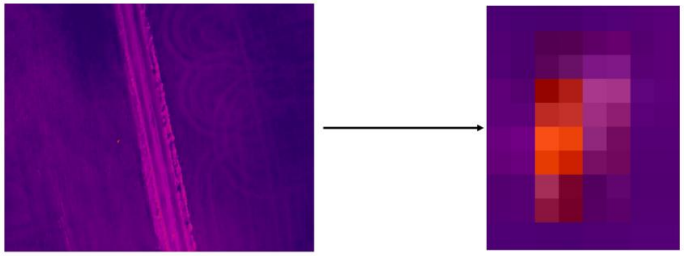
source: https://www.axiomoptics.com/blog/understanding-ifov-and-resolution-in-a-high-resolution-thermal-camera/

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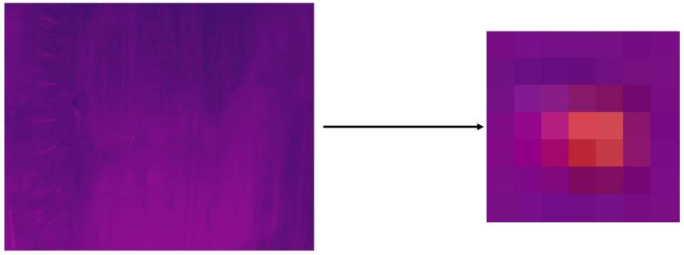
Related work



(a) Image of hare taken at 40 m

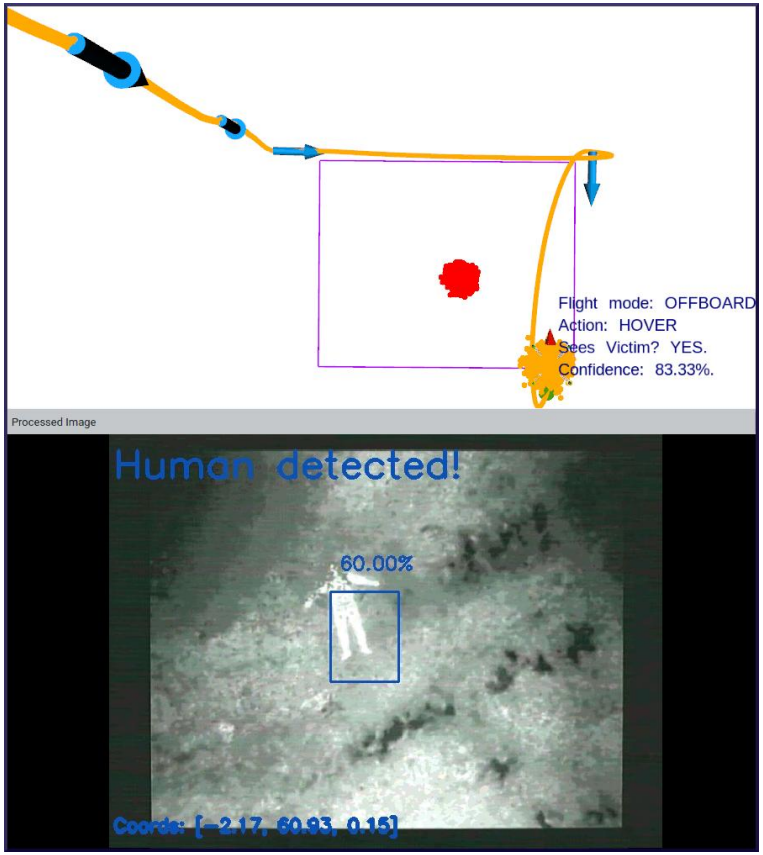


(b) Image of hare taken at 60 m



(c) Image of hare taken at 80 m

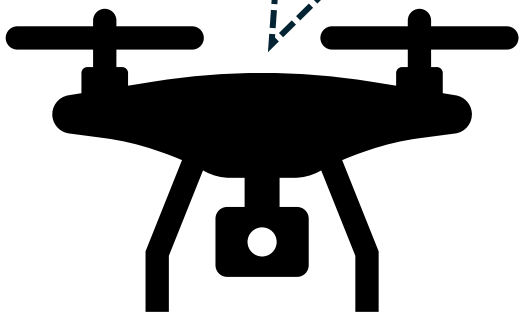
Figure 3. Thermal images of hare taken at an altitude of 40, 60, and 80 m, respectively.



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Information image content modelling

$$I_h = f(x_1, \dots x_i, y_1, \dots y_i \dots)$$



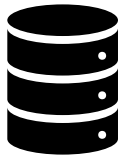
I_h - Information content of the object captured in the image, based on information entropy;

x_i - UAV flight conditions;

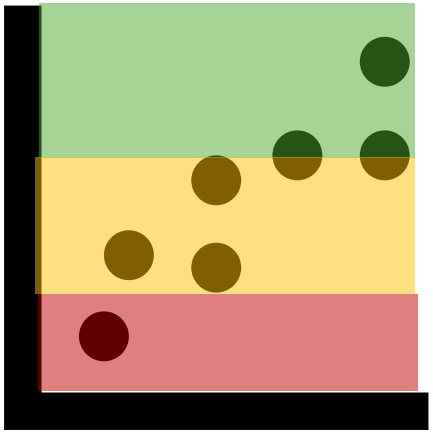
y_i - Other parameters relevant to information content

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Method of evaluating image information content



Shannon's information entropy



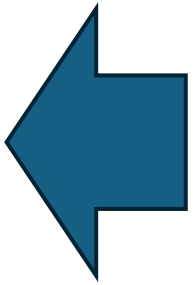




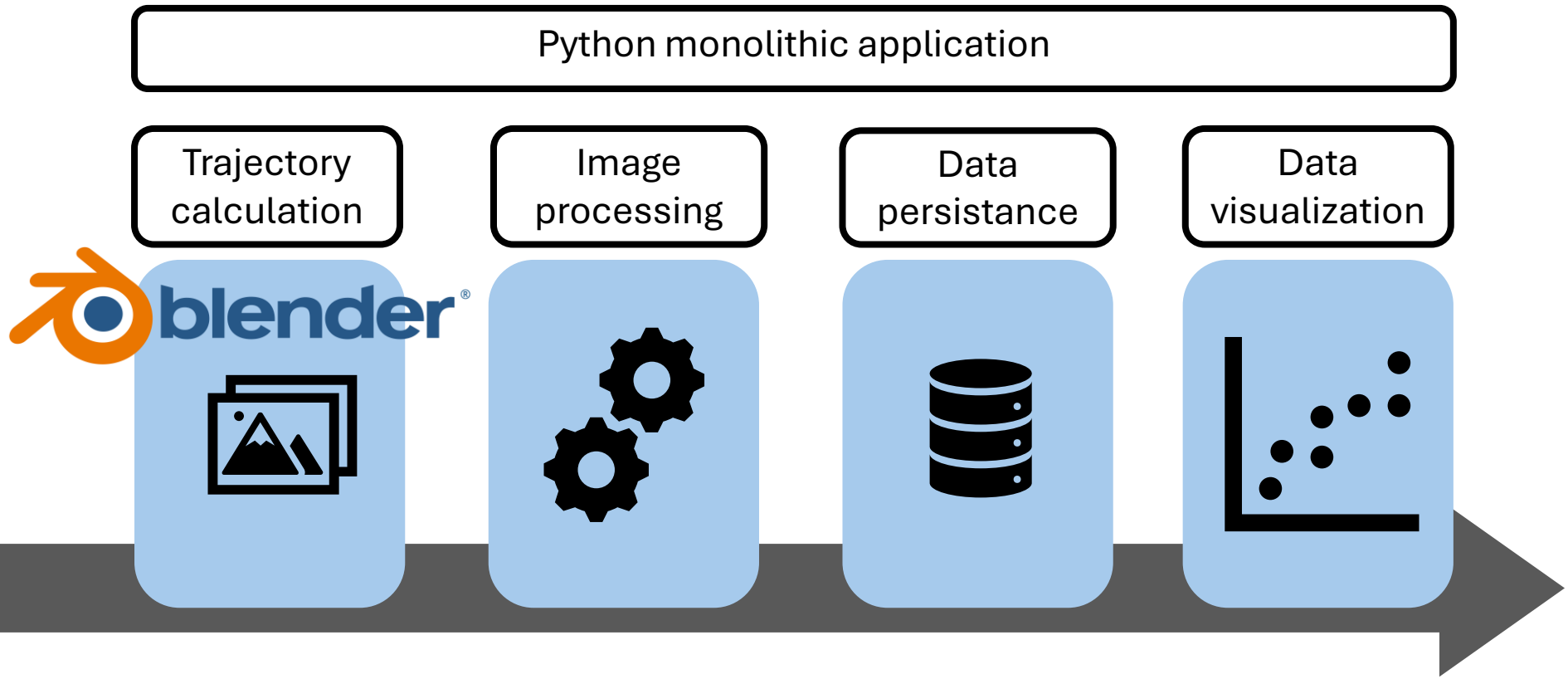
Image datasets

UAV flight parameters



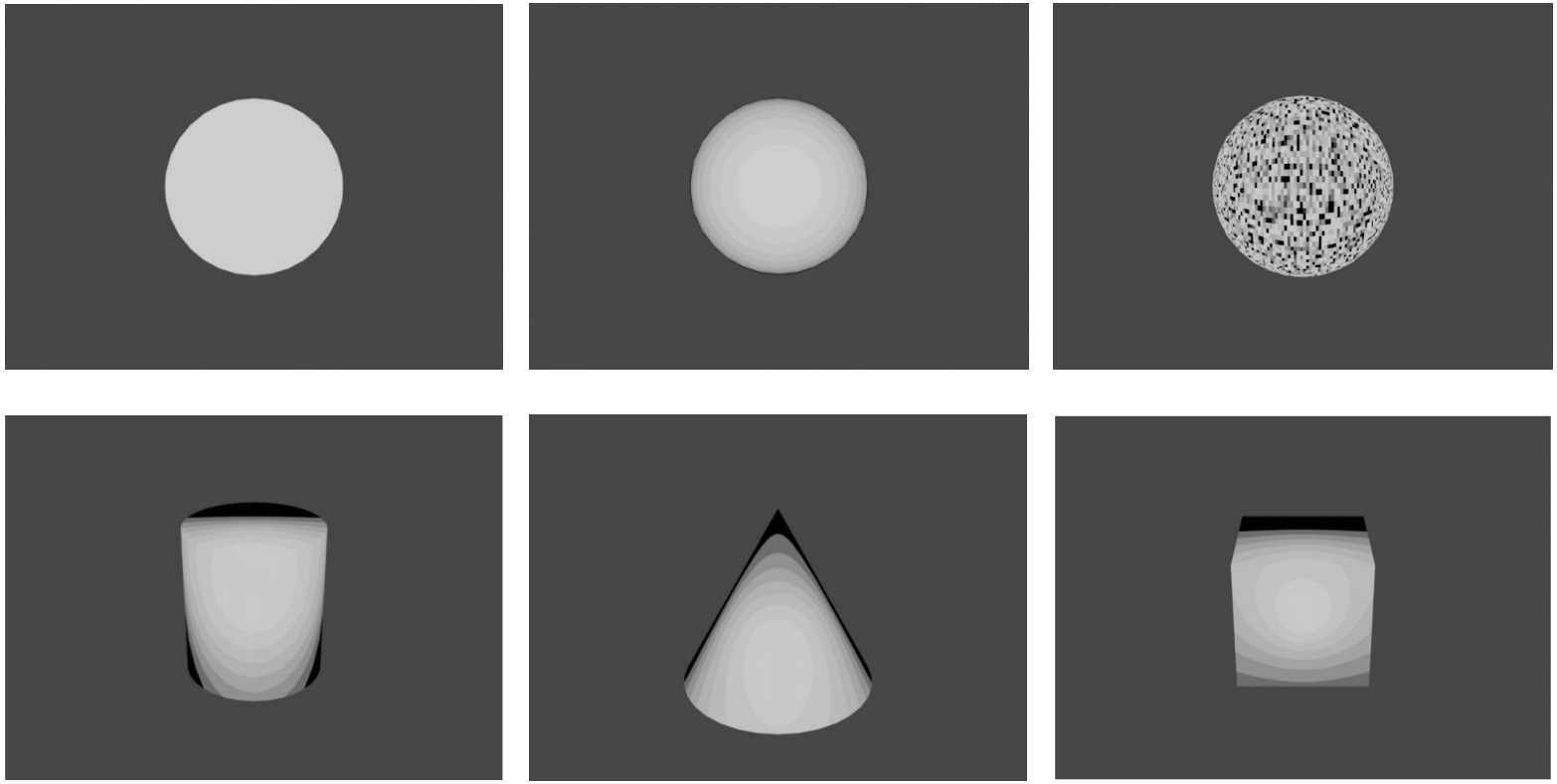
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Image processing framework



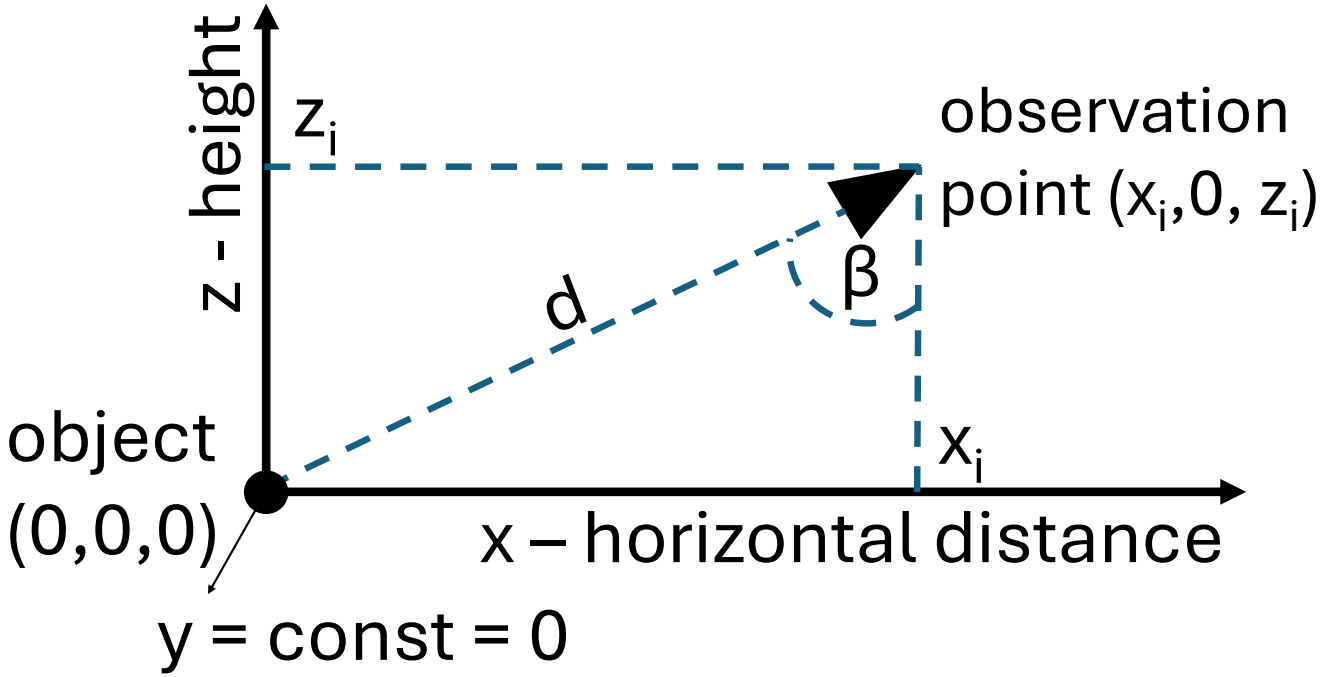
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Theoretical model - objects



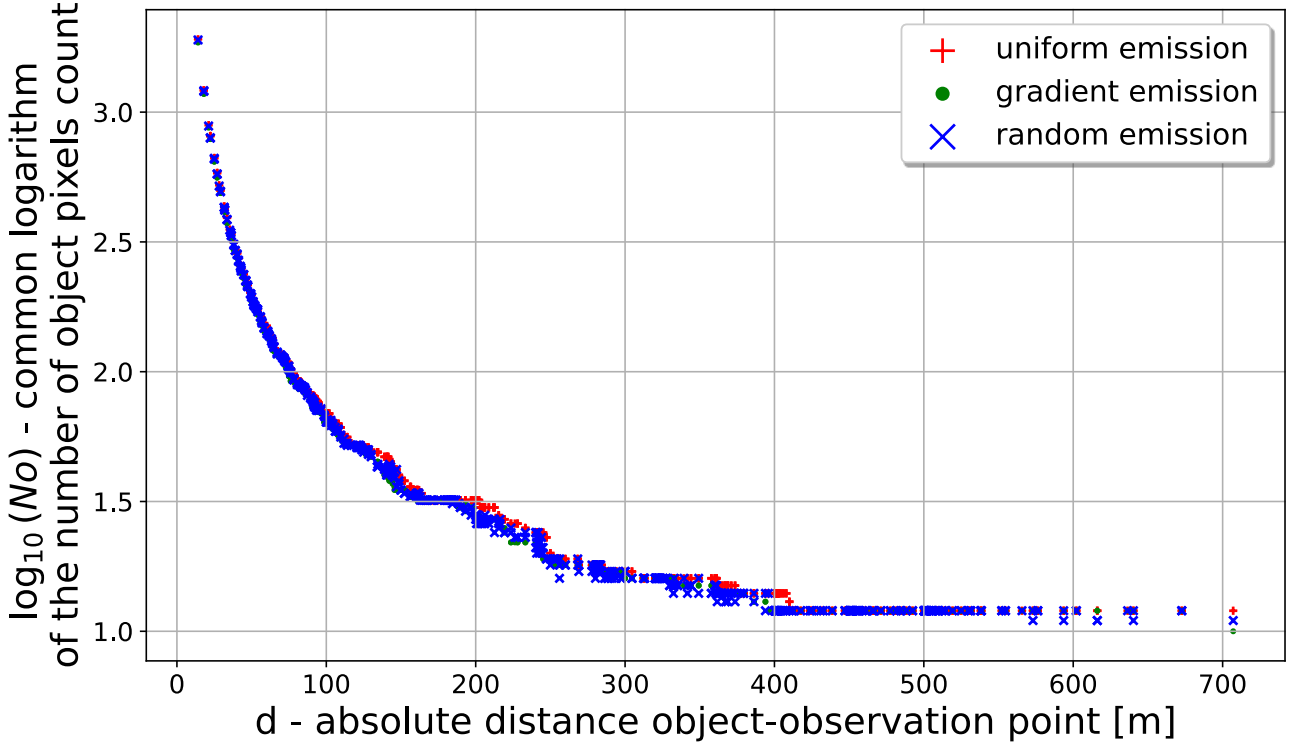
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Theoretical model - setup



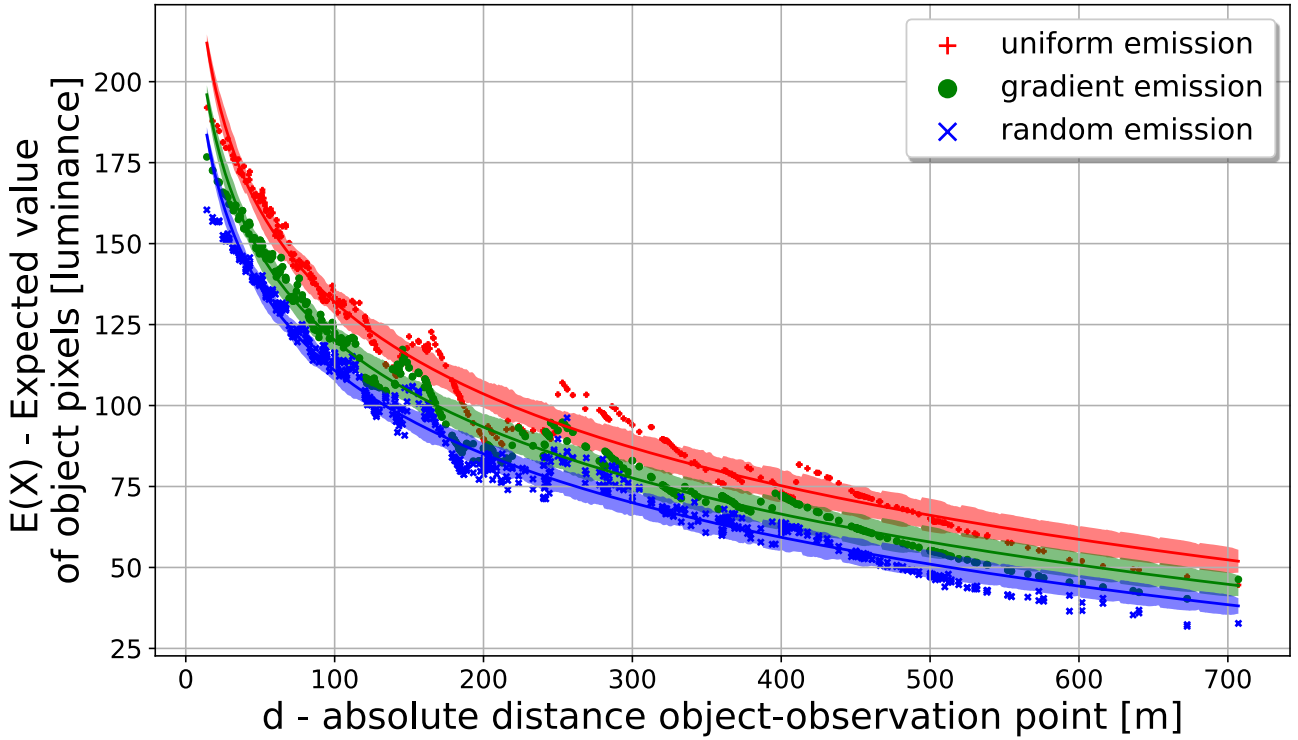
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Theoretical model – outcomes 1/3



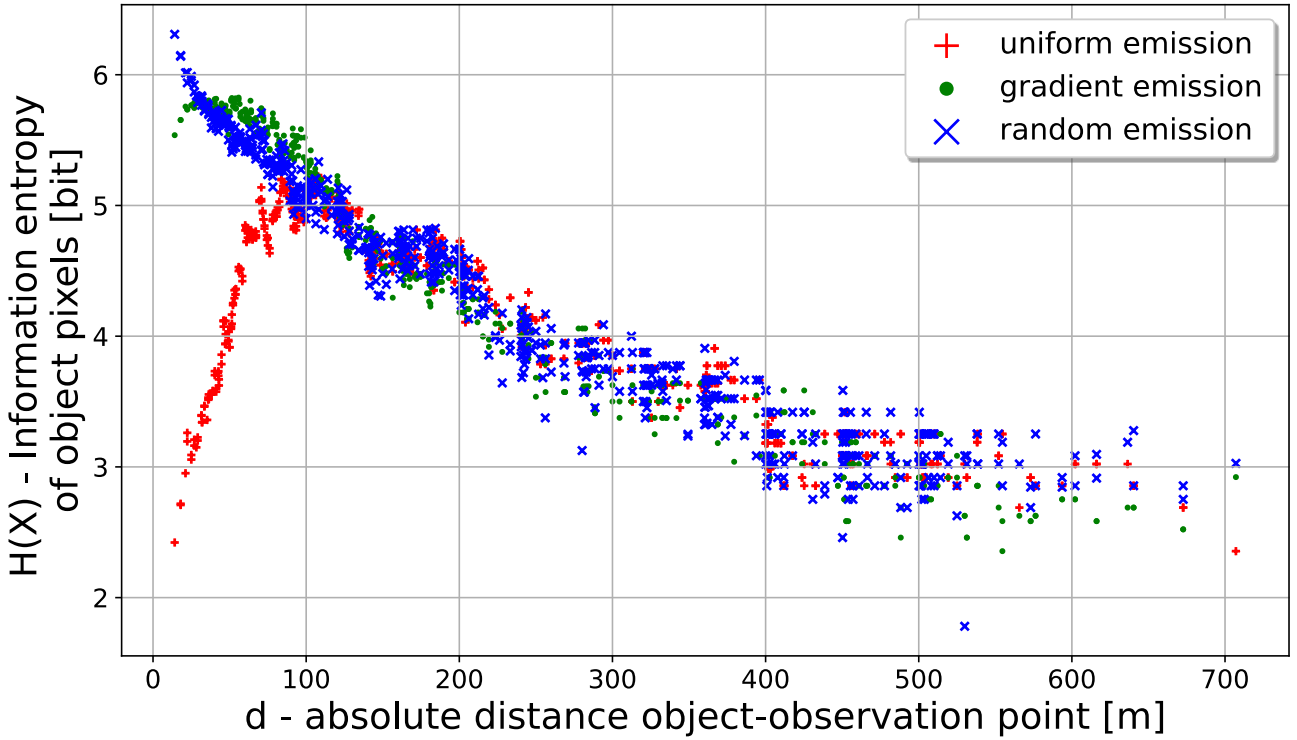
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Theoretical model – outcomes 2/3



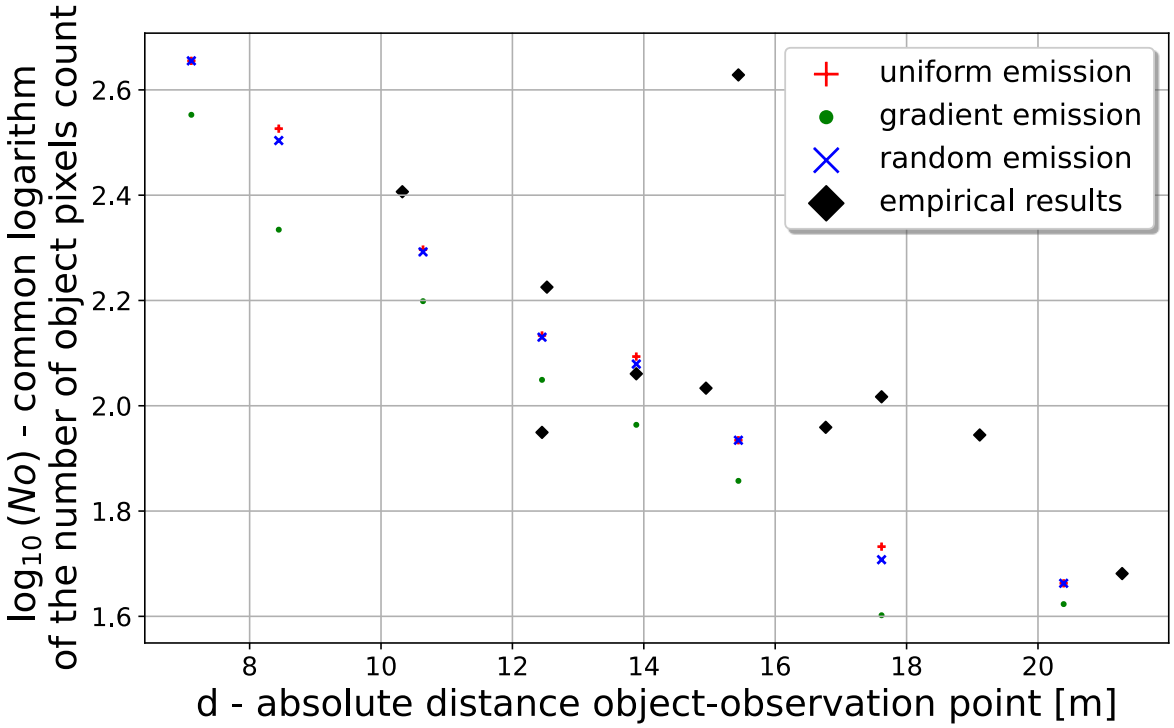
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Theoretical model – outcomes 3/3



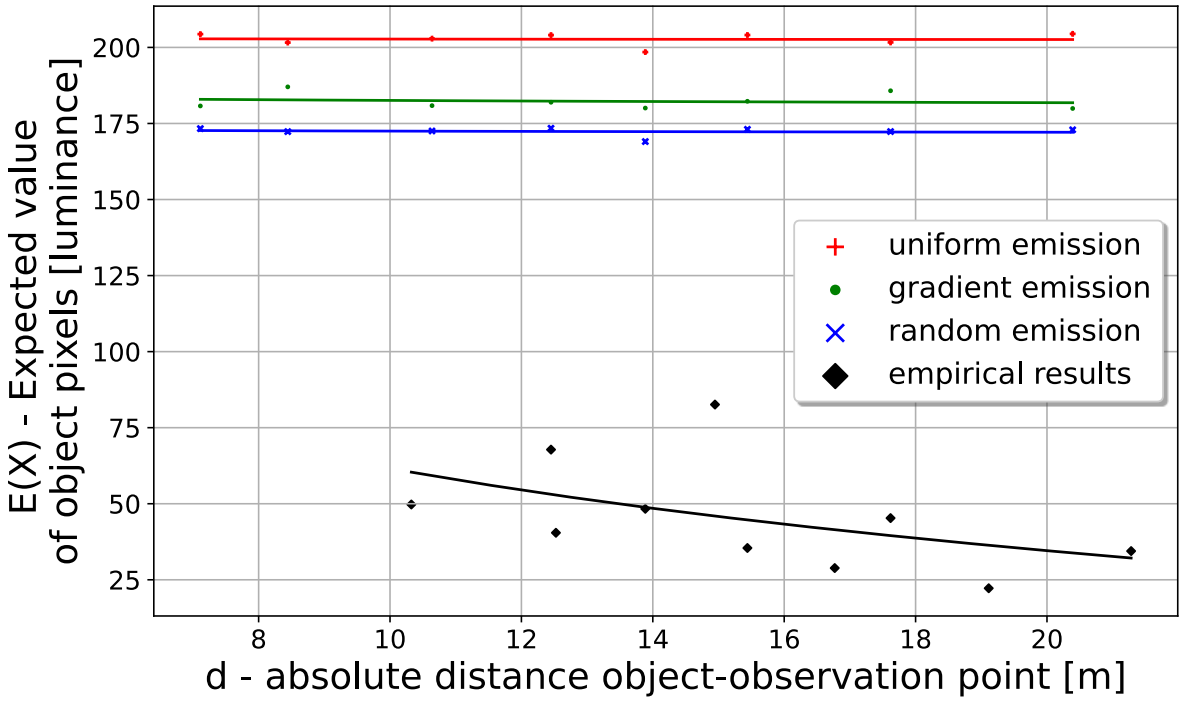
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Empirical evaluation 1/3



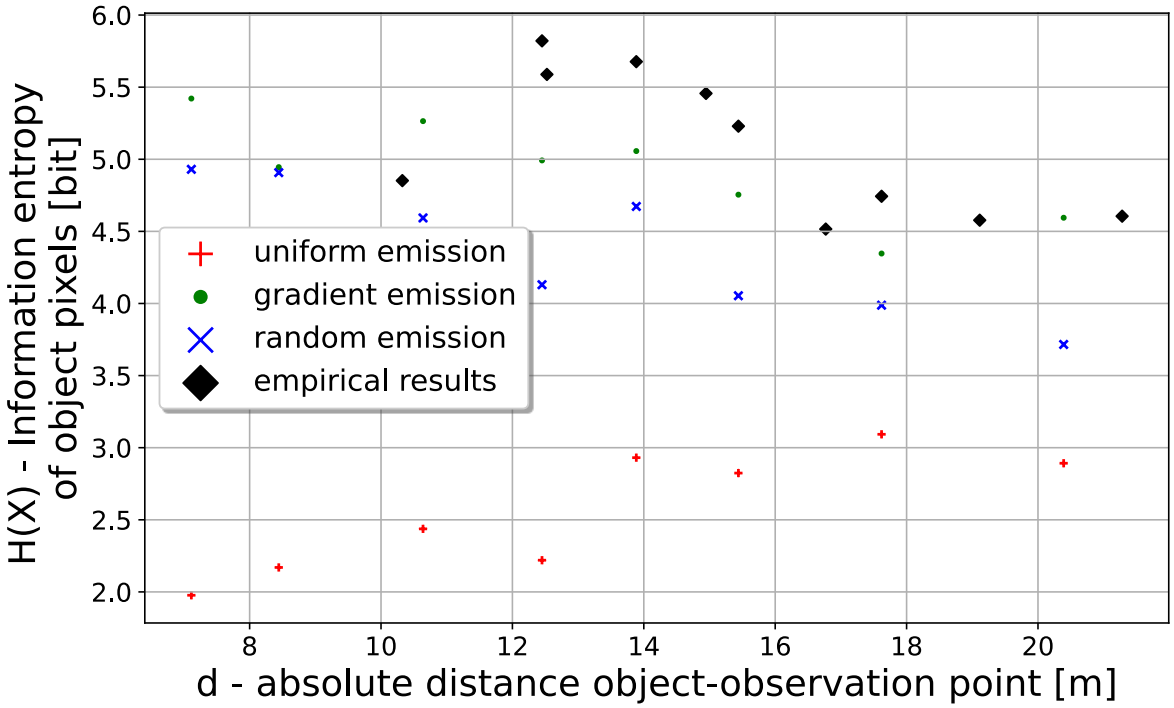
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Empirical evaluation 2/3



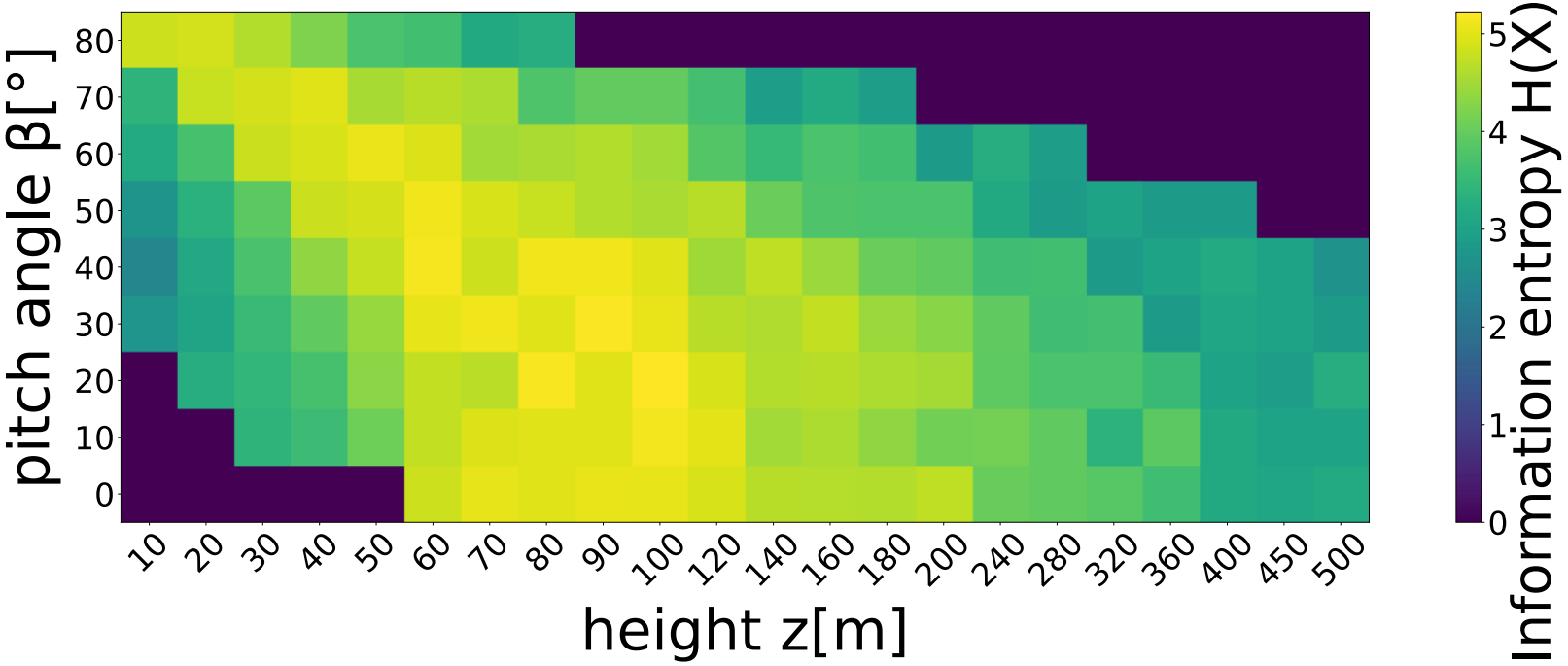
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Empirical evaluation 3/3



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Theoretical model synthesis



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Mentioned sources

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- Z. Mayer, A. Epperlein, E. Vollmer, R. Volk, and F. Schultmann, “Investigating the Quality of UAV-Based Images for the Thermographic Analysis of Buildings”
- J. K. D. Lagman, A. B. Evangelista, and C. C. Paglinawan, “Unmanned Aerial Vehicle with Human Detection and People Counter Using YOLO v5 and Thermal Camera for Search Operations”

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Thank You

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