Inter-annotator consensus: optimizing machine learning for astrophysical feature segmentation and classification

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Problem: large inter-annotator variations

Consequence: incoherent information that impedes training neural networks

Goal: exploit a maximum of annotation information, while maintaining a reasonable level of coherence in the training

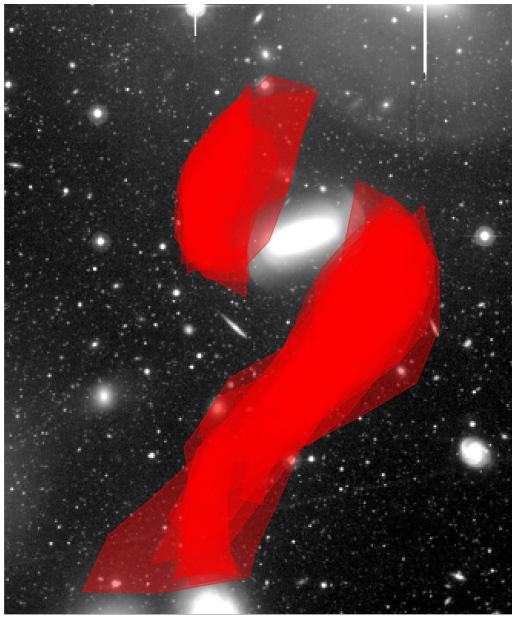

Fig.1: *NGC4249 and all tidal tails annotations*

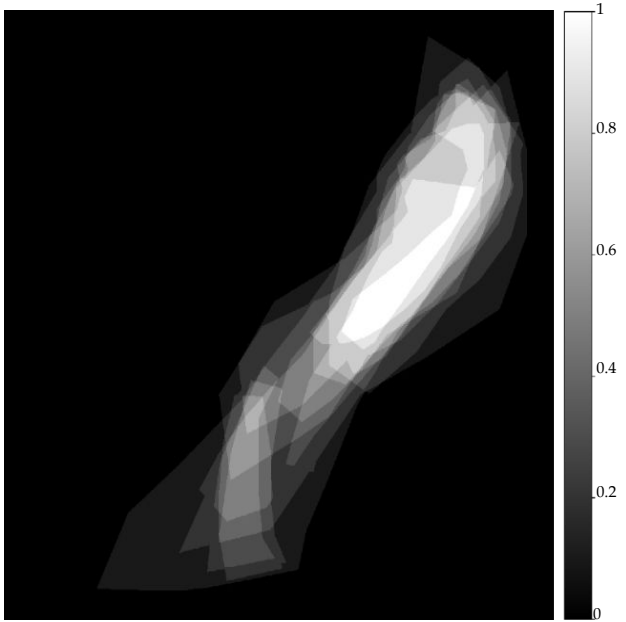

Fig.2: *15 annotations made by 12 annotators on NGC4249 tidal tail.*

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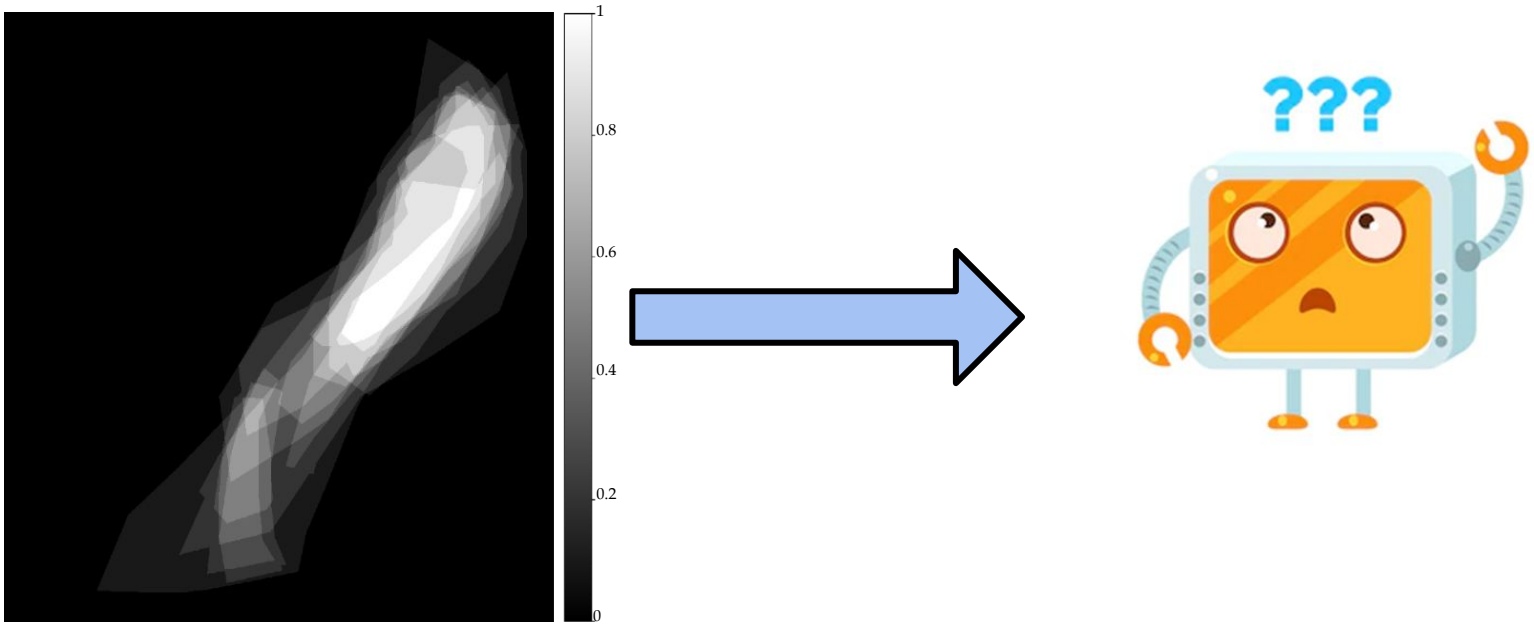

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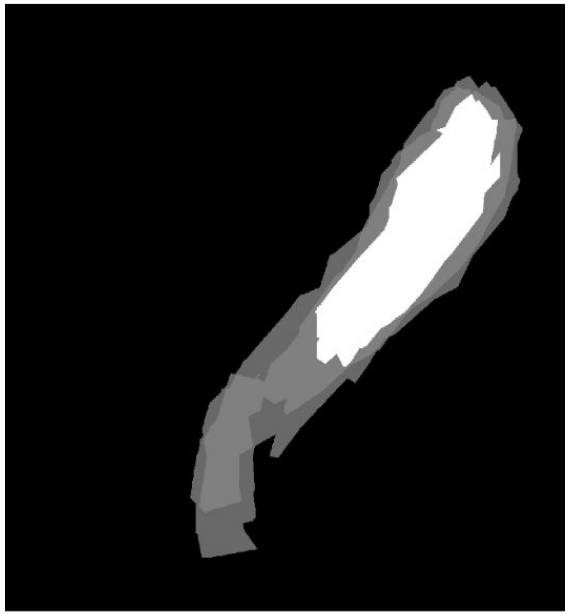

Fig.3: *Something we (the algorithm) understand*

Annotation pairing:

Fig.4: *Annotation made via the annotation tools design by* ***[1]***

Pairwise comparison

automatic identification different/same structure

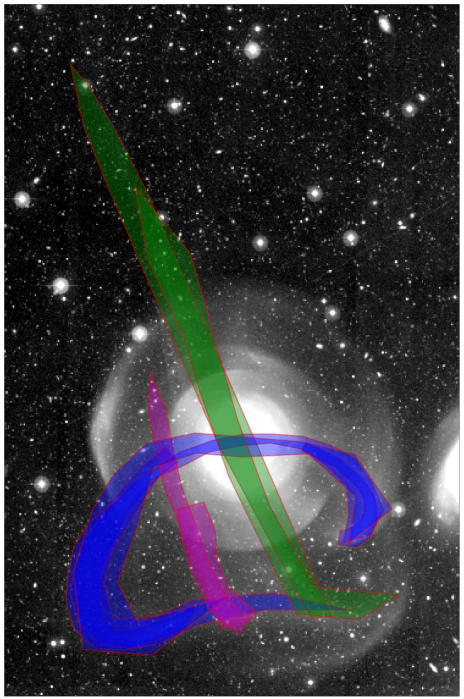

Fig.5: *Annotation grouped by structures*

[1] Elisabeth Sola et al. 2022

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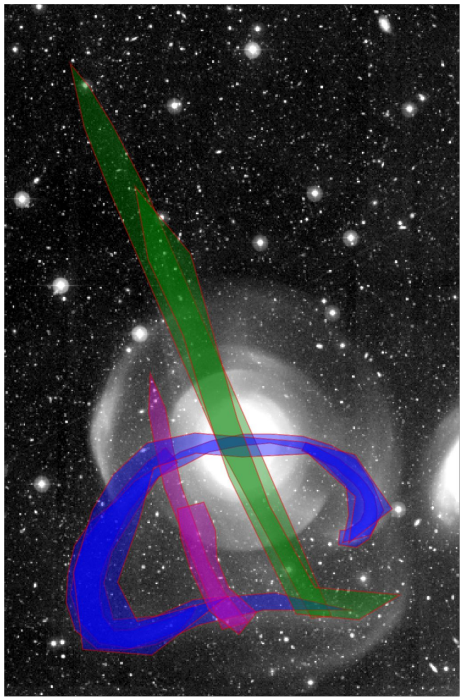
Look at my poster please



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Consensus:

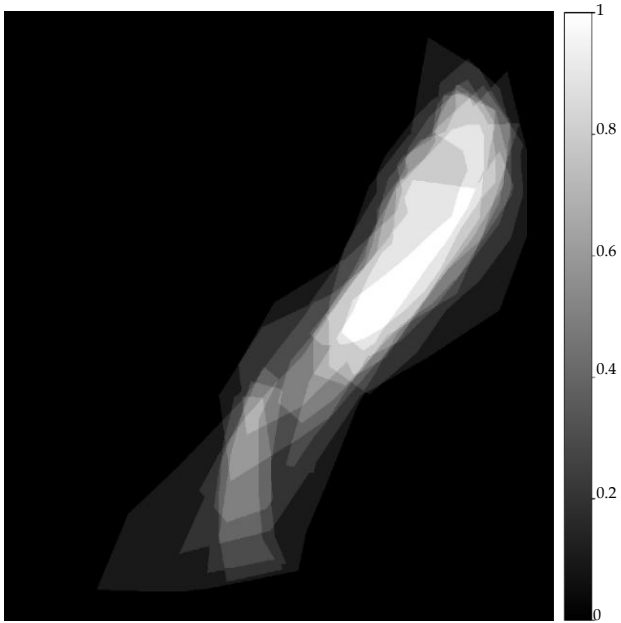


Fig.2: *15 annotations made by 12 annotators on NGC4249 tidal tail.*

coherent for training ?

Consensus: Confidence level

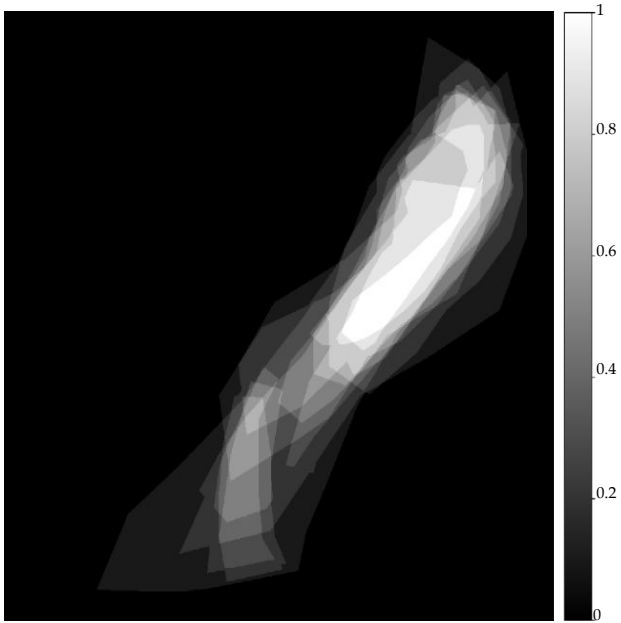
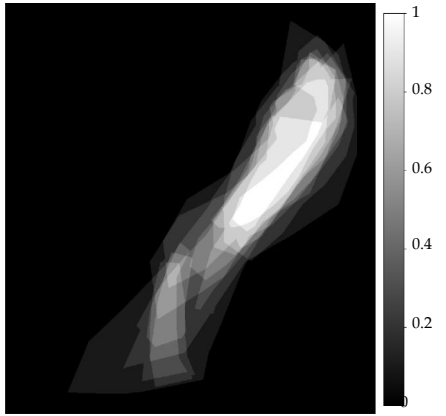


Fig.2: *15 annotations made by 12 annotators on NGC4249 tidal tail.*

Pixel value	Structure presence
0 to 0.25	No
0.25 to 0.5	??
0.5 to 0.75	Fairly sure
0.75 to 1	Yes

Consensus: Confidence level map



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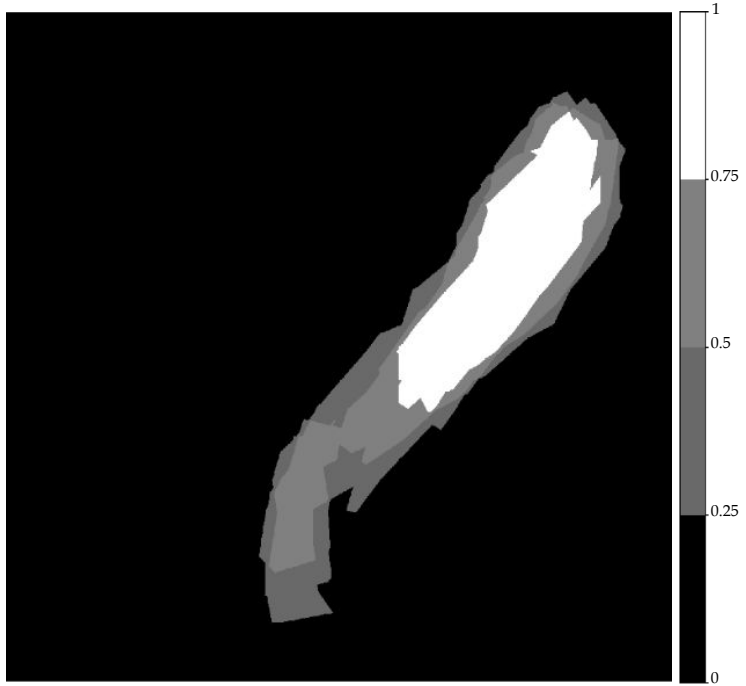

Fig.6: *annotation with confidence levels*

Consensus: Weighted loss function

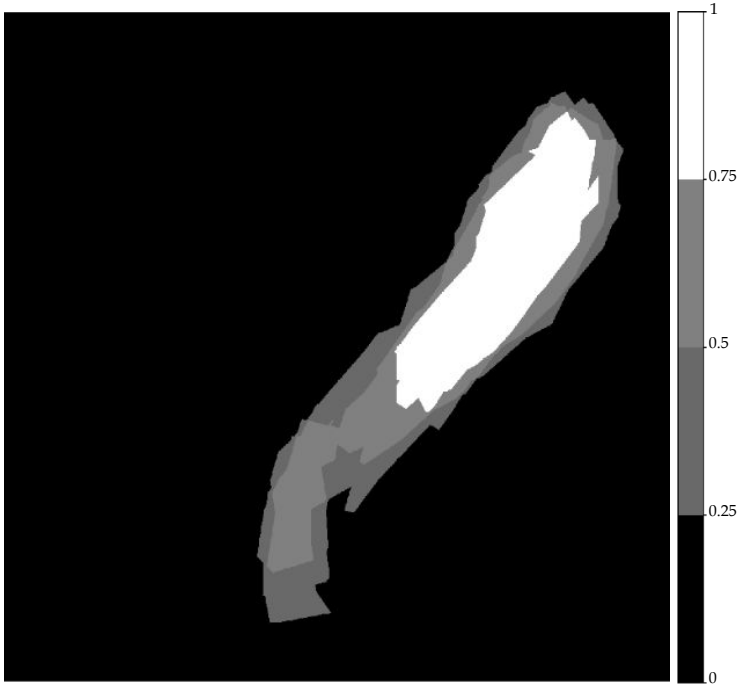

Fig.6: *annotation with confidence levels*

Weight the loss function based on the confidence level in the "ground truth":

$$L_c = \begin{cases} \beta.FL(p_t) & \text{if } y \geq 0.75 \text{ or } y \leq 0.25 \\ FL(p_t) & \text{if } 0.5 \leq y \leq 0.75 \\ 0 & \text{if } 0.25 \leq y \leq 0.5 \end{cases}$$