Multimodal Noisy Segmentation based fragmented burn scars identification in Amazon Rainforest

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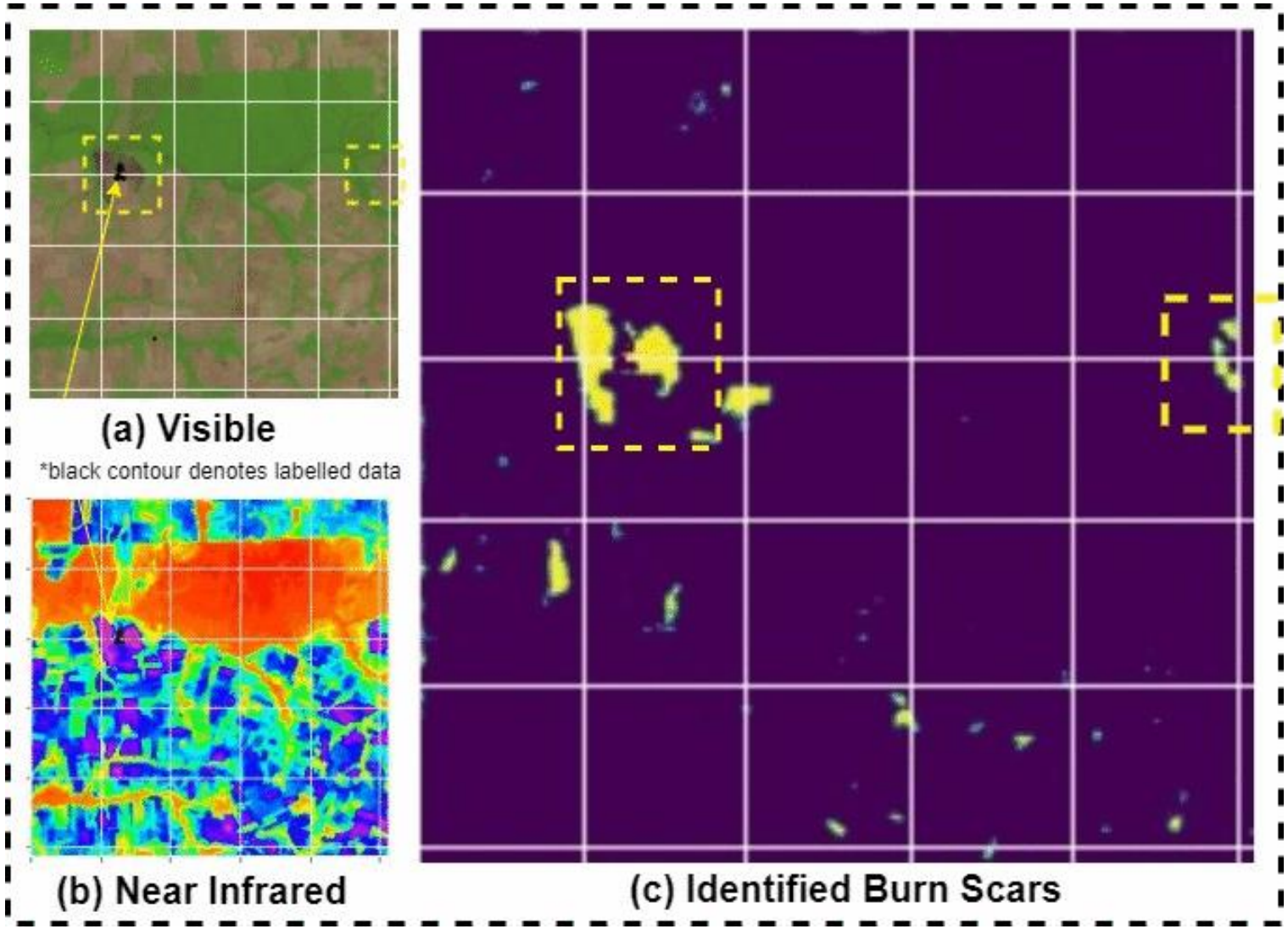

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Slash-and-Burn is one of the most used practices in Brazilian agriculture , also a major cause of Amazon Rainforest Fires.

Overview of burnings in the vicinity of BR-163 highway, Para, northern Brazil, in Amazon region. Used with permission from Mr. Gustavo Basso.

Identification of burned areas swiftly & accurately is an important problem

- Many environmental studies & management activities require accurate identification of burned areas

- Remote sensing approaches have become cost effective alternatives for estimation & detection, post wildfire monitoring, including burn area and severity estimation.

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Current Burn scar identification methods inadequate…

- Current works use techniques like auto-correlation, self organizing maps, linear spectral mixture model, SVM, random forests.
- Although deep learning segmentation methods have made debut recently in remote sensing, the spread is very limited.
- For Burn Scar Identification, no recent works seem to utilise current deep learning methods for like CNN or encoder-decoder models like SegNet or U-Net.
- Lest alone in a multimodal setting.

…. largely due to lacking data.
But can we use noisy labels?

- Lack of datasets in remote sensing generally.
- But noisy data for burn scar identification was curated by INPE Brazil.
- Contains unlabelled instances & mislabelled instances. Difficulty not only in training but also in validating the goodness of model.
- Goes into PU Learning and Label Noise Learning which is an evolving field.
- Our objective: can we get a working model without diving into these?

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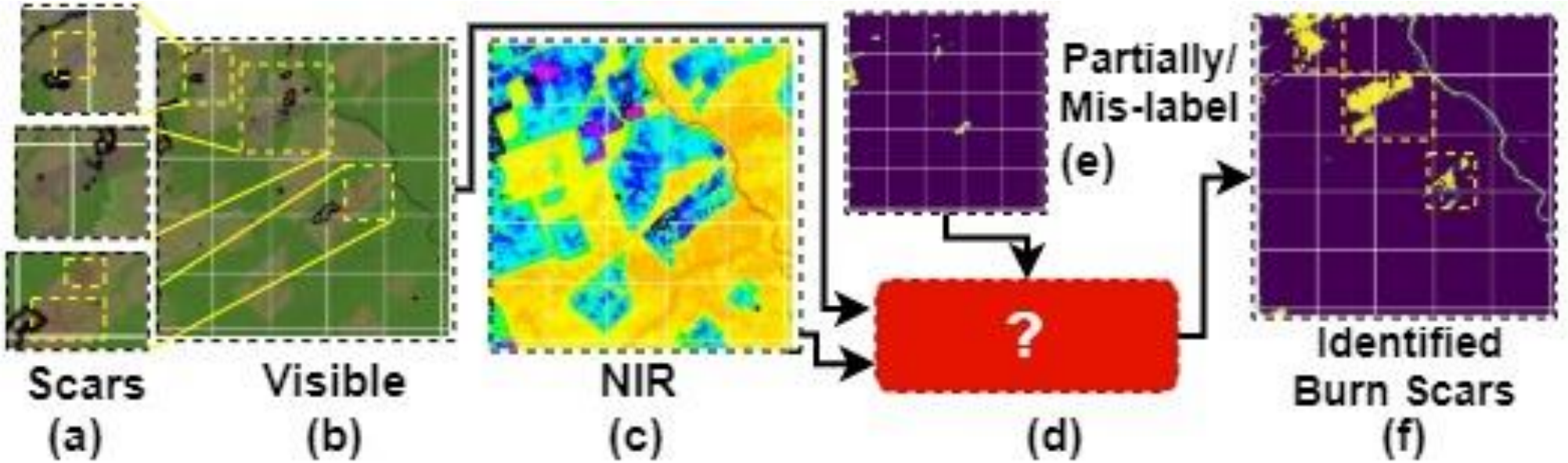
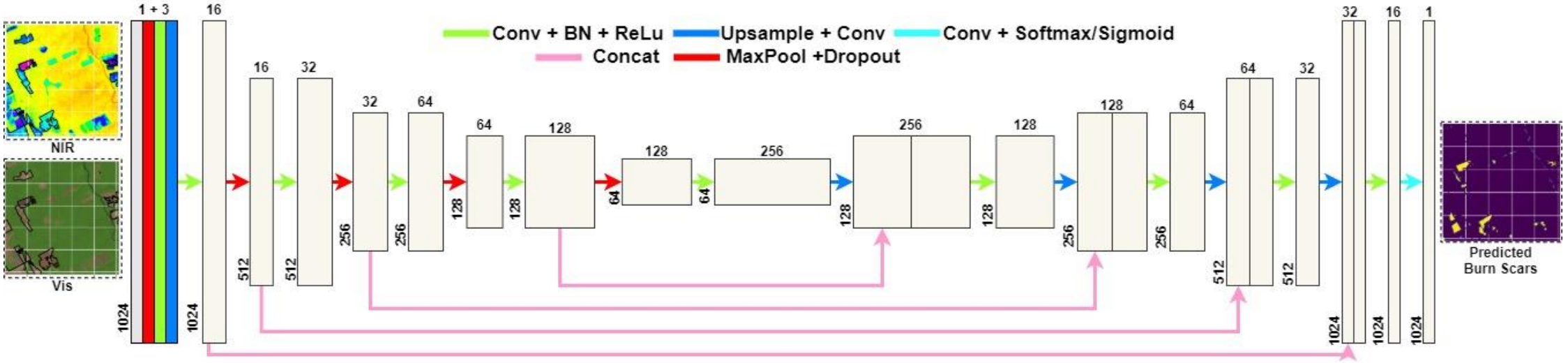
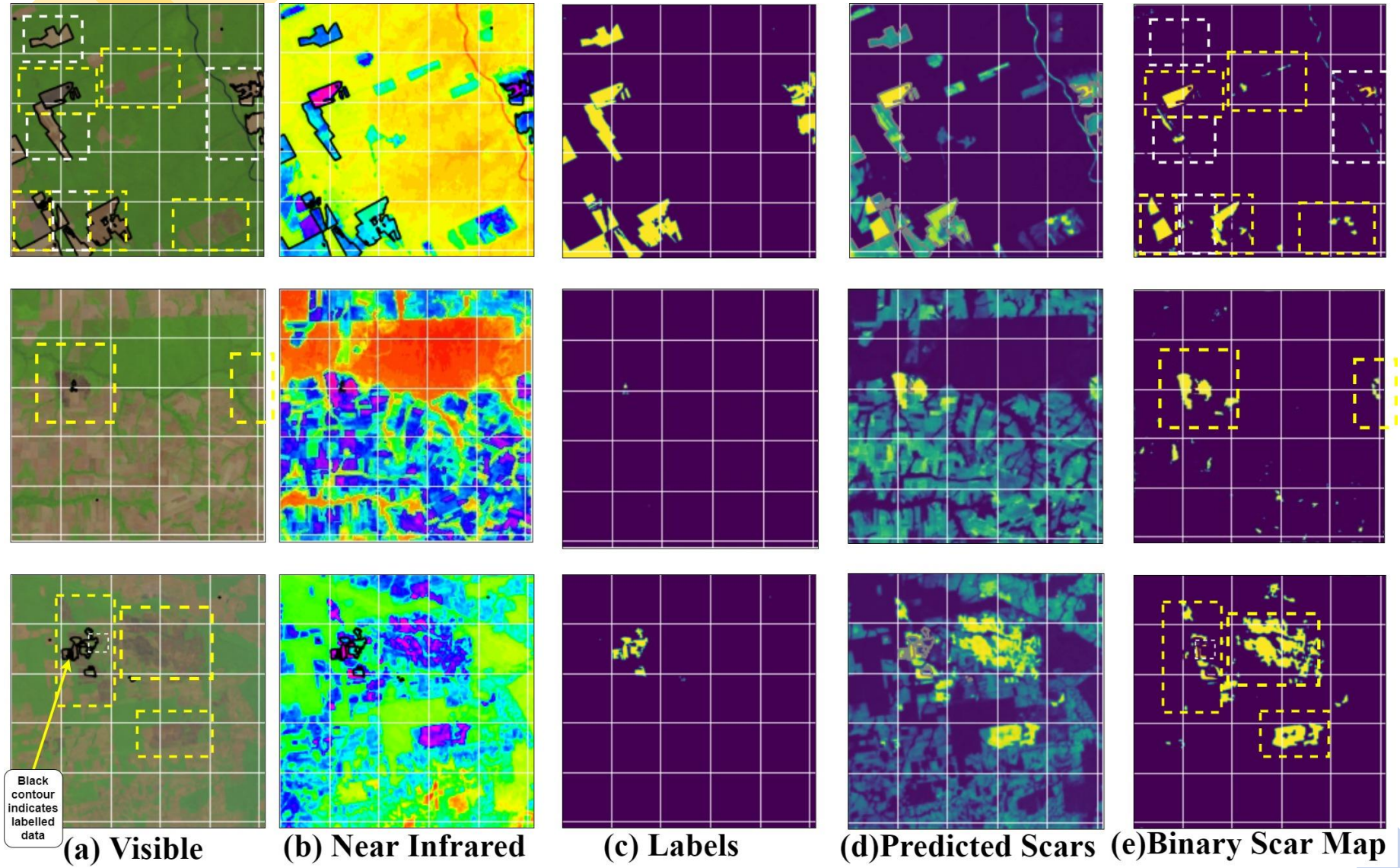


Generic schematic of a multi-modal noisy, weakly labelled burn scar identification. (a) Unlabelled/Correctly labelled burn scars (b) Visible Band (c) Near Infrared Band (d) Unknown Model (AmazonNET) (e) Partially/ Noisy training labels (f) Output burn scar map

We assumed that the dataset is mostly correctly labelled &…

…decided to start with a U-Net model





Results: It works…

- The model obtained a training accuracy of 69.51% & a validation accuracy of 63.33%.
- Correctly identifies unlabeled fragmented burn scars (denoted as yellow-dash boxes) and deselects wrongly labelled areas

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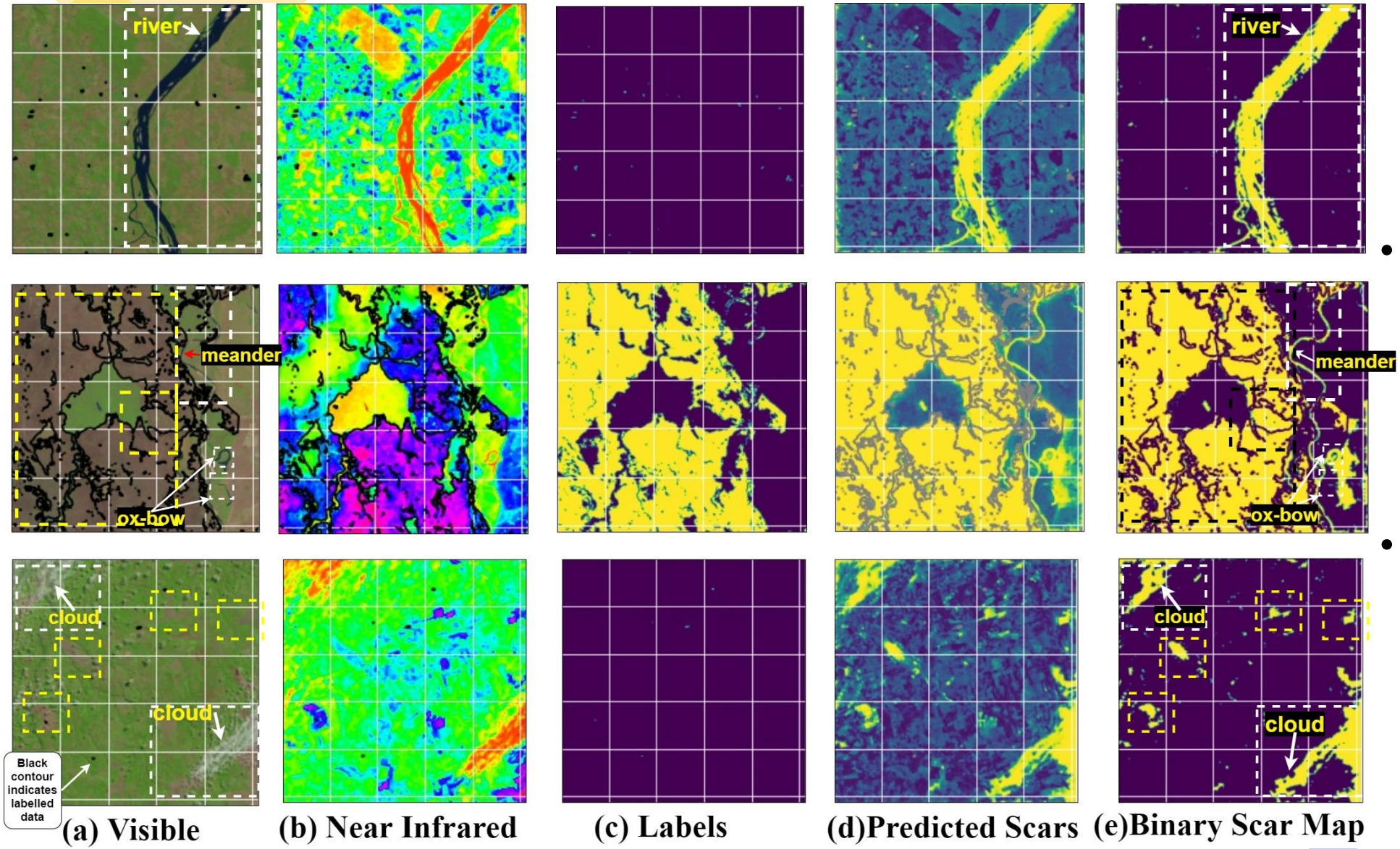

…Mostly!

- Defects emerge when our network segments (a) river (b) meanders and ox-bow lake and (c) clouds as burn scar patterns.
- This can be attributed primarily to (i) lack of any labelled examples and (ii) negligible samples containing the above geographical features in the dataset.

Why did we do this?

- Firstly, because nobody had tried segmentation using encoder-decoder model types in burn scar identification.

- Secondly, and more importantly, not only we show that burn scar segmentation can be done (as expected!), but

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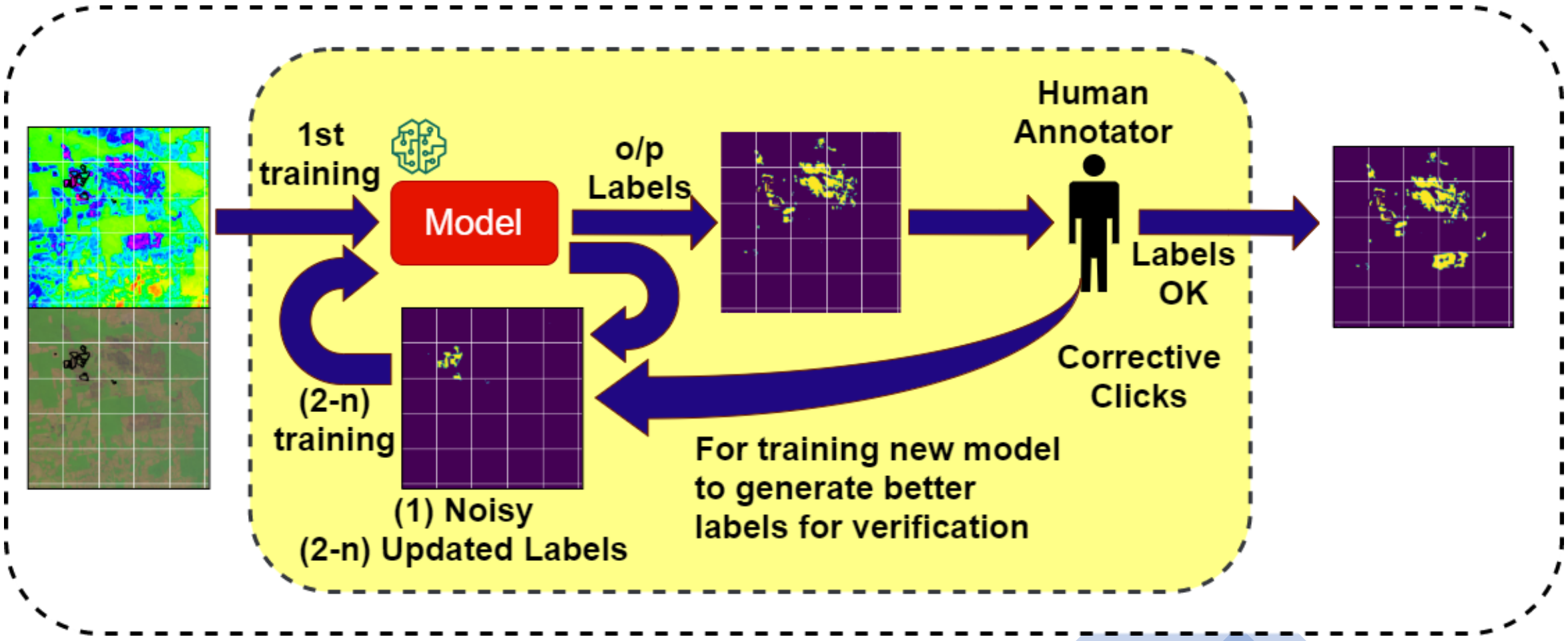
But now we can do the training of the network in a human-in-the-loop learning setup to iteratively make the network and the dataset better, which can then be released later as a general remote sensing dataset!



In this work we…

- Utilized a partially/mis-labelled dataset representing burn patterns…
- Correctly identified actual scars & reject incorrect labels using UNET…
- We presented shortcomings & consider resolving these by iteratively training the model and updating the dataset in HITL setting to generate a finely labelled dataset and an accurate model.

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Thank You!

Any questions about our work are gladly welcomed and can be sent to

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