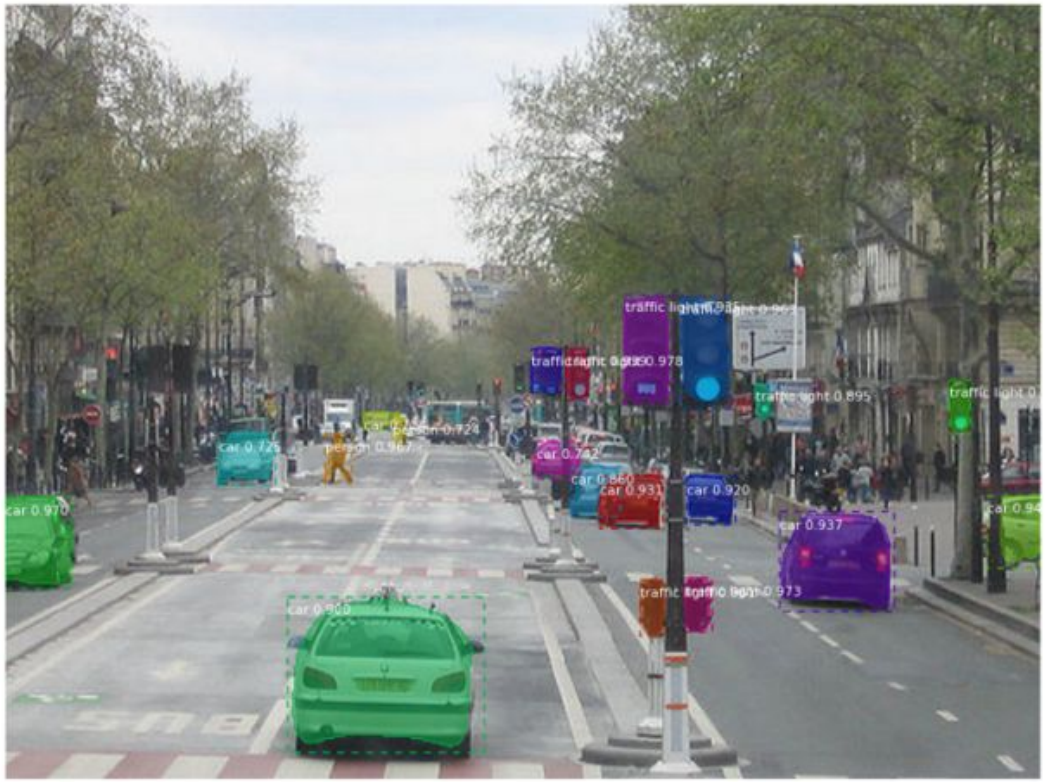
Proposal-based Instance Segmentation with Point Supervision

Laradji et al. accepted at ICIP2020

Instance Segmentation with Point Supervision

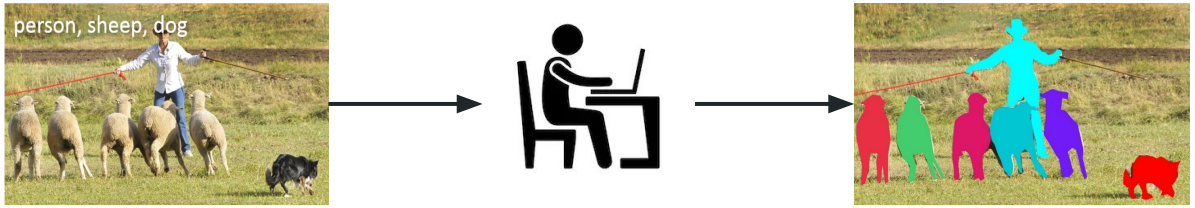
Motivation



Instance Segmentation with Point Supervision

Motivation

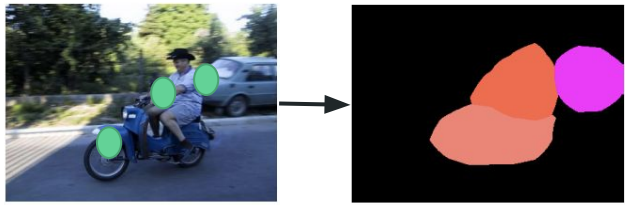
Per-pixel labels require 1.5 hours/image



Point-level labels require few seconds/image

Instance Segmentation with Point Supervision

Related work



Point annotations

FCN8 Predictions

What's the point [ECCV 2016]

CAM

Affinity

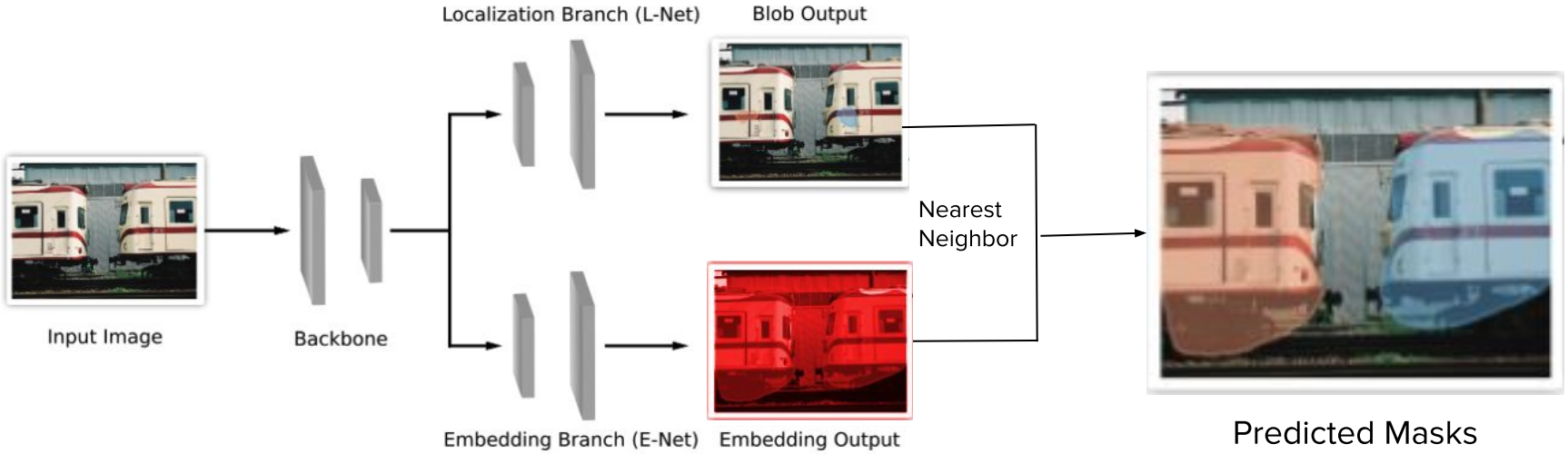
Pseudo labels

Learning semantic affinity [CVPR 2018]

However, these are weakly supervised semantic segmentation methods

Instance Segmentation with Point Supervision

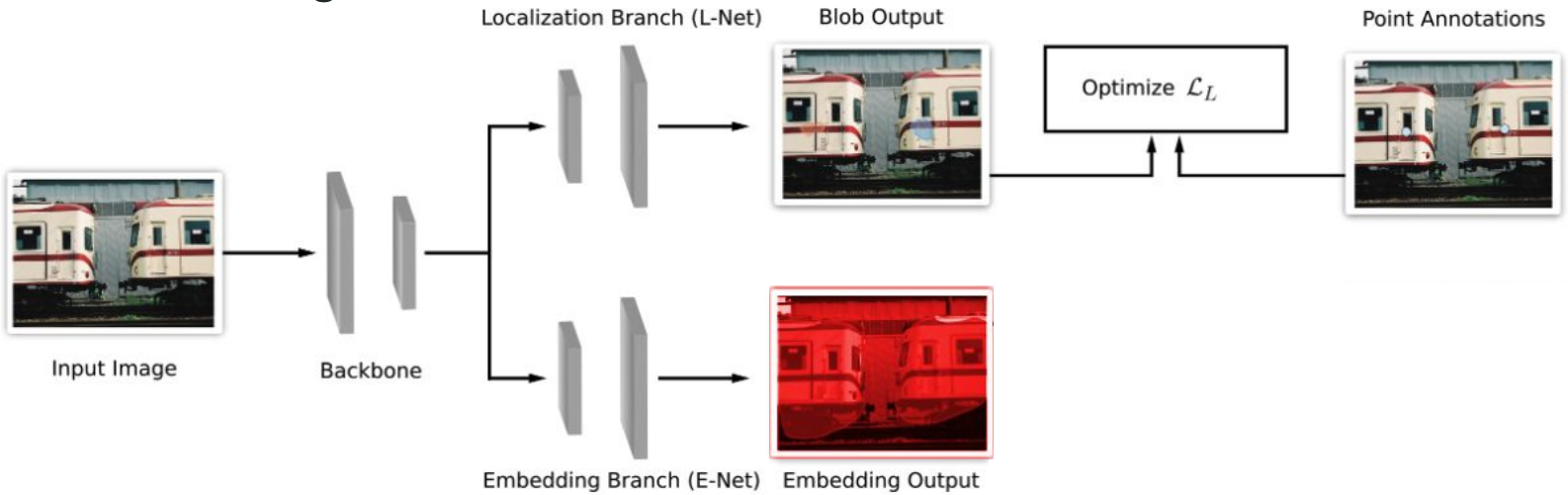
WISE-Net Prediction



- Locate the objects with the localization branch
- Obtain the masks with the embedding branch

Instance Segmentation with Point Supervision

WISE-Net Training

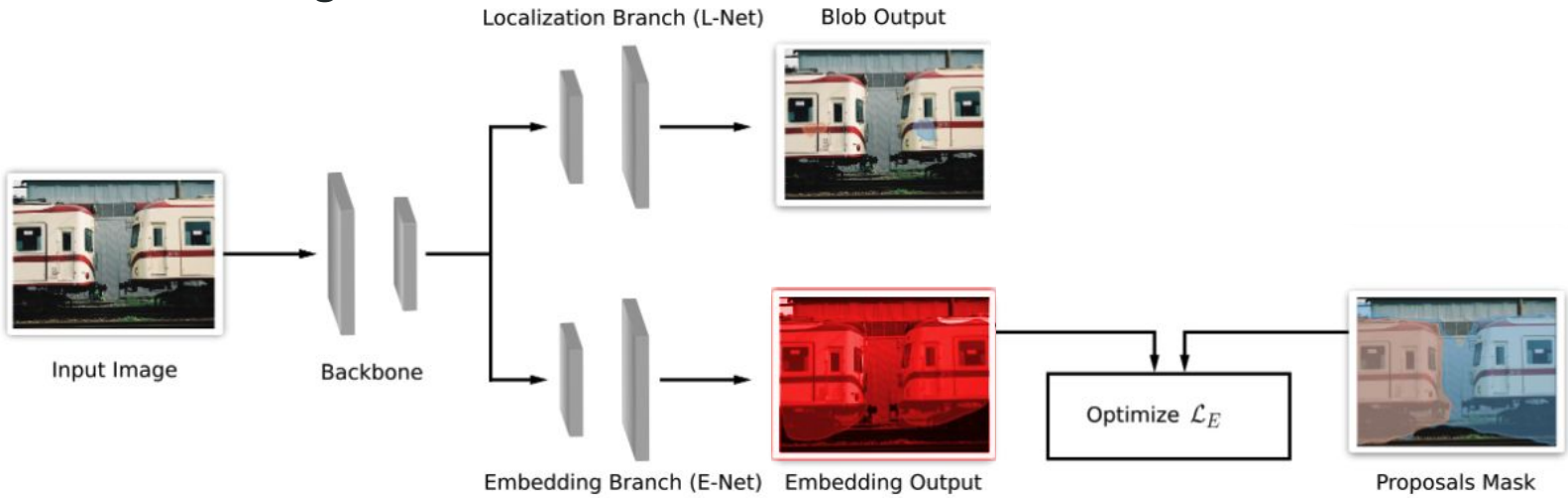


- LCFCN loss to predict the object locations:

$$\mathcal{L}_L = \underbrace{\mathcal{L}_I(S,T)}_{\text{Image-level loss}} + \underbrace{\mathcal{L}_P(S,T)}_{\text{Point-level loss}} + \underbrace{\mathcal{L}_S(S,T)}_{\text{Split-level loss}} + \underbrace{\mathcal{L}_F(S,T)}_{\text{False positive loss}}$$

Instance Segmentation with Point Supervision

WISE-Net Training



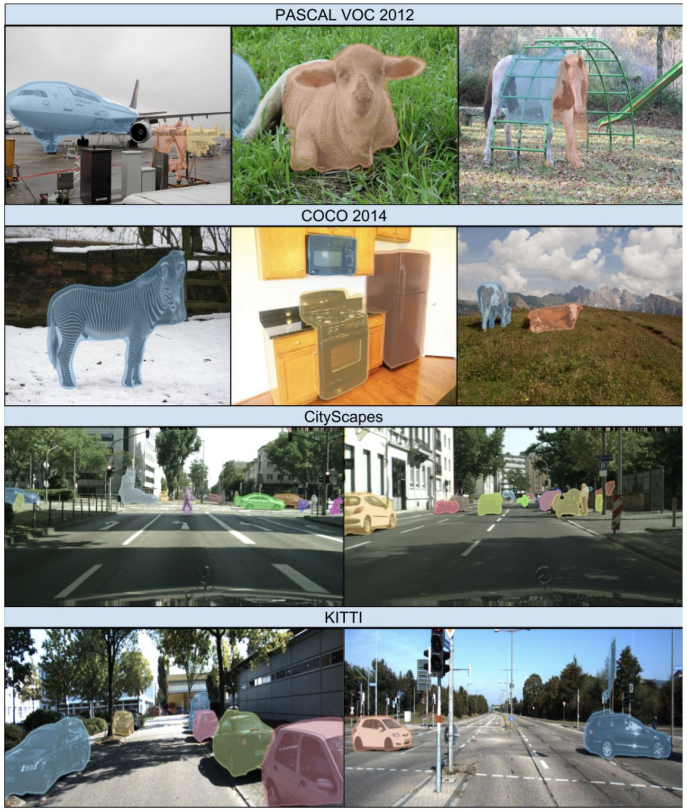
- Similarity loss makes pixels of the same object have similar embeddings:

$$\mathcal{L}_E = -\sum_{(i,j)\in P} \left[\mathbb{1}_{\{y_i = y_j\}} \log S(E_i, E_j) \; + \; \mathbb{1}_{\{y_i \neq y_j\}} \log \left(1 - S(E_i, E_j)\right) \right]$$

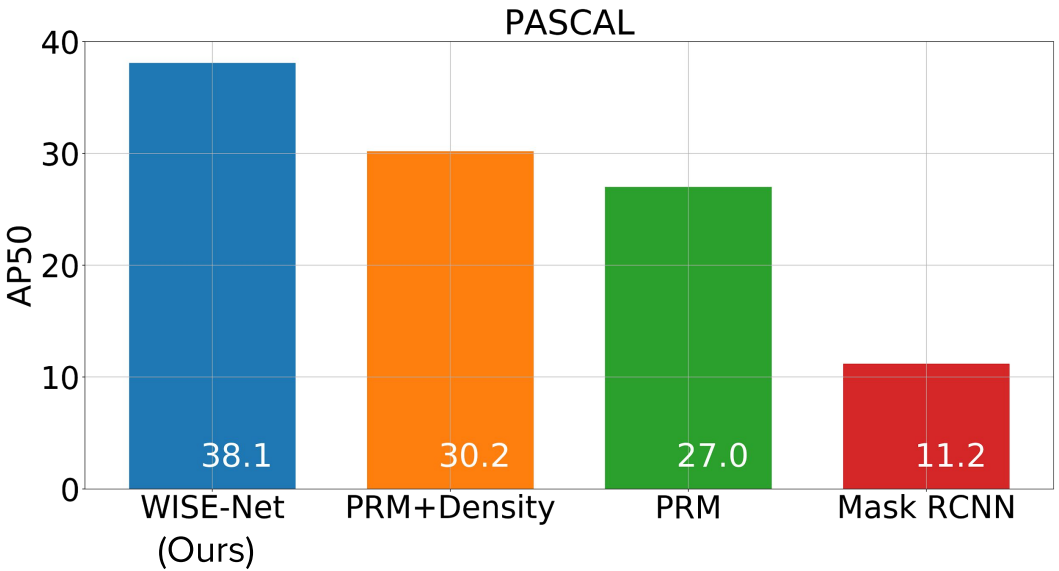
where few points are sampled from the proposals and from the background regions

Instance Segmentation with Point Supervision

Results



Same labeling effort are given for each of these methods



Higher AP50 is better

Instance Segmentation with Point Supervision

Conclusions

- A novel framework instance segmentation with point supervision
- Outperforms fully- and weakly-supervised methods for fixed annotation budget
- Established a first strong baseline for the problem setup
- Check out our code in https://github.com/IssamLaradji/wisenet

Instance Segmentation with Point Supervision

Real life applications

Instance Segmentation with Point Supervision

Real life applications

WISE (Ours)

Annotator then refines these masks