Gated Feedback Refinement Network for Dense Image Labeling

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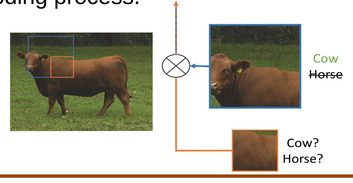
❖ Goal:

- Incorporate fine details to get precise labeling.
- Effective integration of local and global contextual information

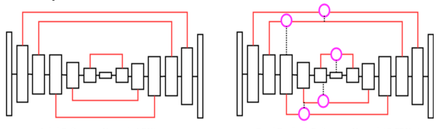
❖ Motivation:

- Relationship between receptive field size across layers, and ambiguity that may arise in decoding process.



❖ Background:

- Encoder-Decoder architecture
- Skip connections

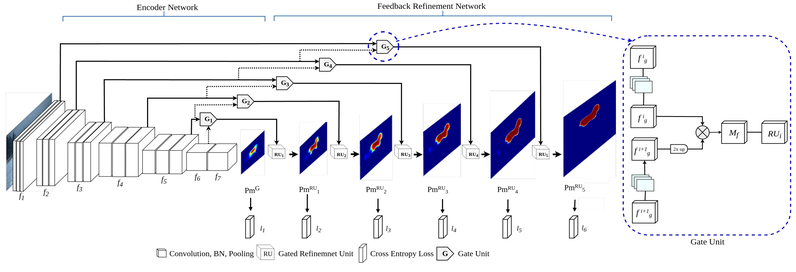


❖ Contributions:

- Coarse-to-Fine predictions
- Gating Mechanism
- Deep Supervision

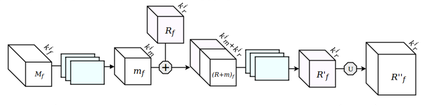
❖ Our Approach:

- We propose to solve the problem in a coarse-to-fine fashion by first predicting a coarse labeling, then progressively refining this coarse grained prediction towards finer scale results.
- We introduce a novel gating mechanism to modulate how information is passed from the encoder to the decoder in the network.
- Stage-wise supervision



❖ Gate Units & Gated Refinement Unit:

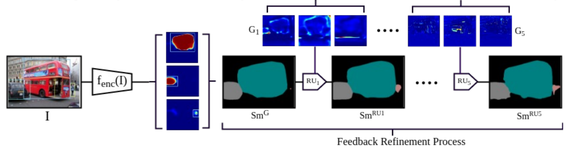
- Designed to control the information passed on
- Generate rich contextual information



$$v_i = T_f(f_g^{i+1}), u_i = T_f(f_g^i), M_f = v_i \odot u_i \qquad m_f = \mathbb{C}_{3\times3}(M_f), \gamma = m_f \oplus R_f, R'_f = \mathbb{C}_{3\times3}(\gamma)$$

❖ Gated Refinement Scheme & Stage-wise Supervision:

- Progressively improves the spatial details of dense label maps

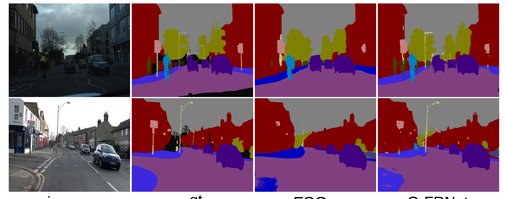


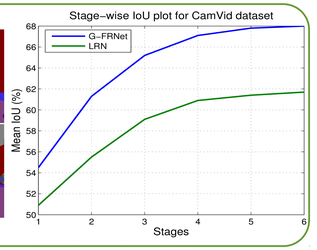
Visualization of hierarchical gated refinement scheme

❖ Experiments:

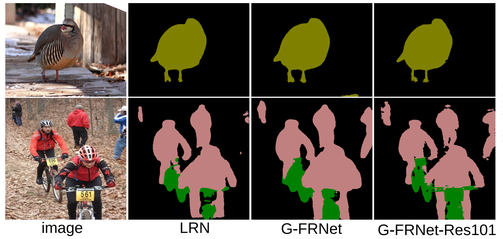
- Dataset: CamVid, PASCAL VOC 2012, and Horse-Cow Parsing

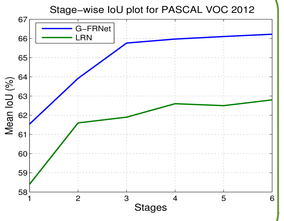
Methods	mIoU
SegNet	50.2
DeepLab	61.6
Dilation	65.3
FSO	66.1
LRN	61.7
G-FRNet	**68.0**



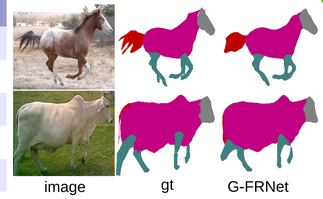


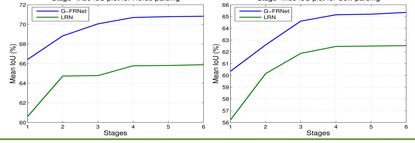
Methods	mIoU
SegNet	59.1
DeepLab	71.6
DeepLabv2	**79.7**
LRN	64.2
G-FRNet	70.4
G-FRNet-Res101	79.3

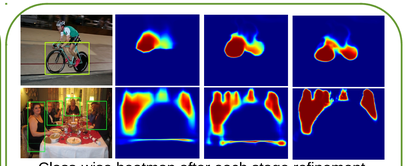




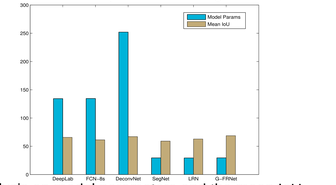
Methods	mIoU	mIoU
SPS	50.3	48.0
HC	61.9	52.5
JPO	67.0	57.1
L-LSTM	68.7	62.7
LRN	65.8	62.5
G-FRNet	**70.8**	**65.3**







Class-wise heatmap after each stage refinement



Analysis on model parameters and the mean IoU