

Semantic Image Segmentation with Deep Convolutional Nets and Fully Connected CRFs

Paper Review

er1ca

What is CNN(Convolutional Neural Network)?

Idea is ..

A bit of history:

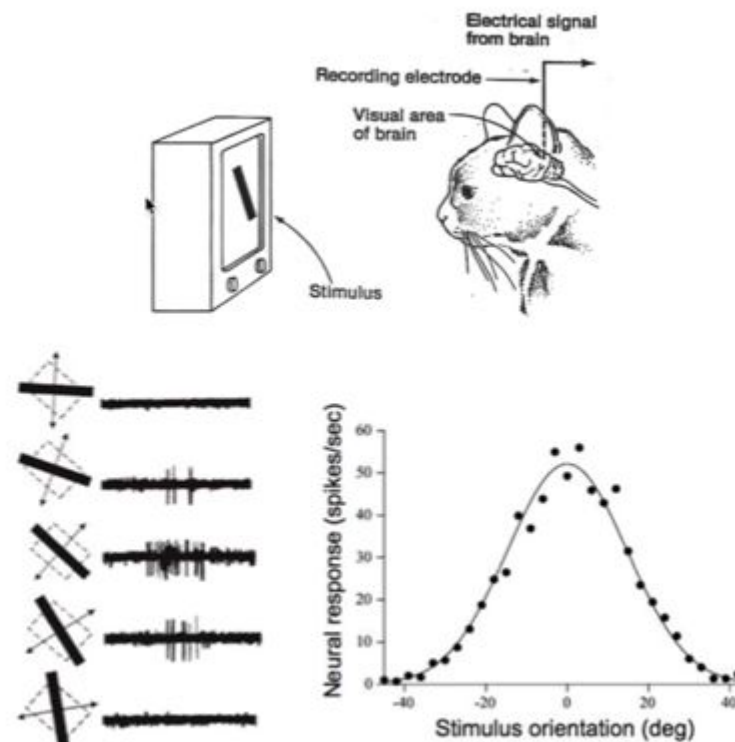
**Hubel & Wiesel,
1959**

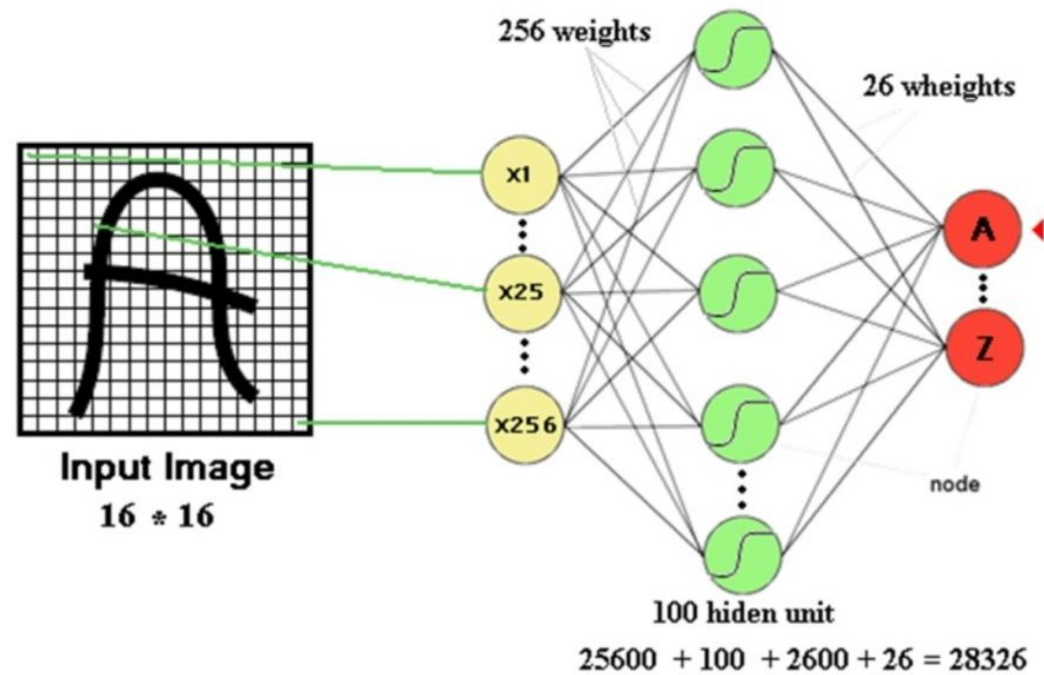
RECEPTIVE FIELDS OF SINGLE
NEURONES IN
THE CAT'S STRIATE CORTEX

1962

RECEPTIVE FIELDS, BINOCULAR
INTERACTION
AND FUNCTIONAL ARCHITECTURE IN
THE CAT'S VISUAL CORTEX

1968...





이미지를 잘게 쪼개서 각각의 입력으로 나열 !

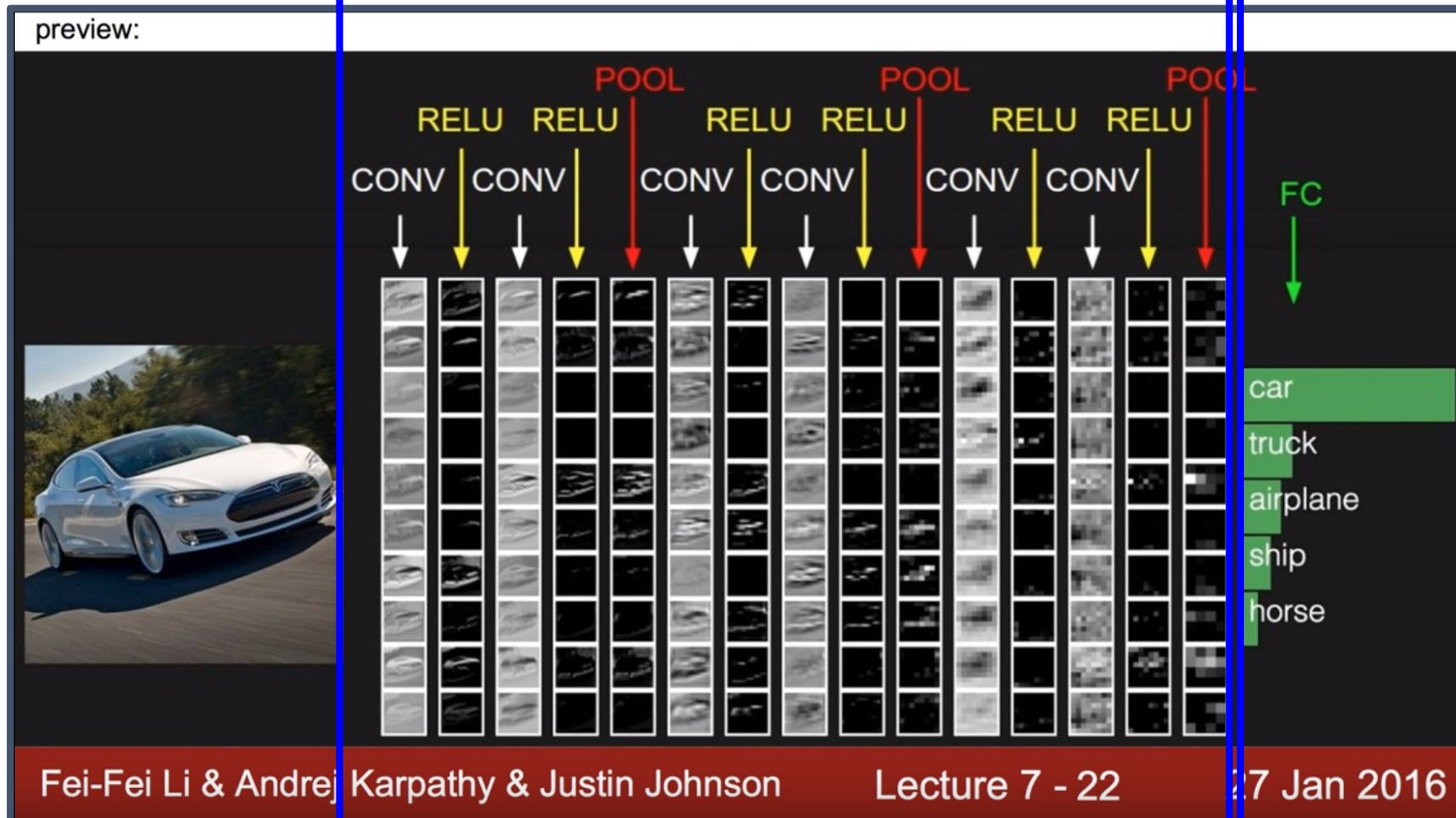
Architecture of CNN(Convolutional Neural Network)



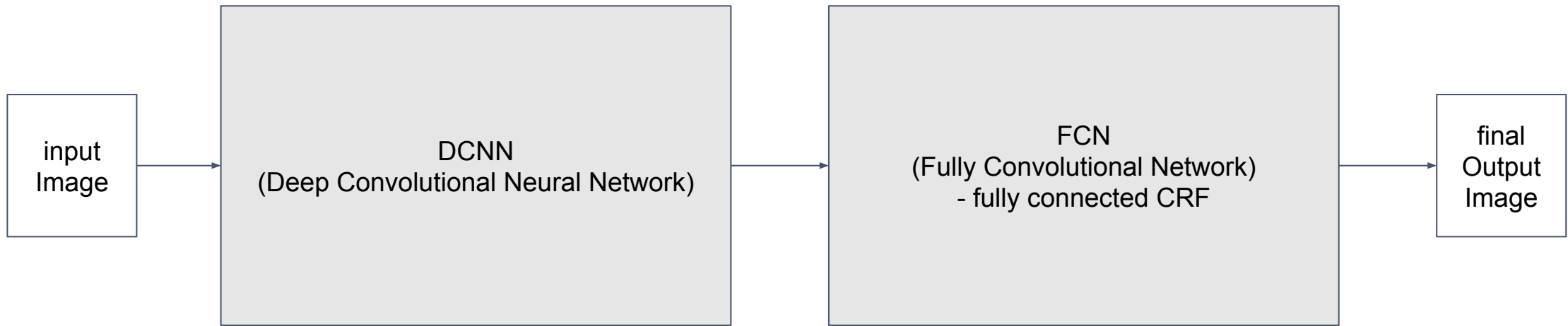
1. subsampling 단계 : 특징 추출
2. 동일한 weight의 filter 반복적용 단계 : topology 변화에 무관한 항상성 얻음
3. classification 단계 : 분류기 (ex AlexNet, VGGNet, GoogLeNet etc)

conv + pooling

classification



Let's Simplify DeepLap V2



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Segmentation

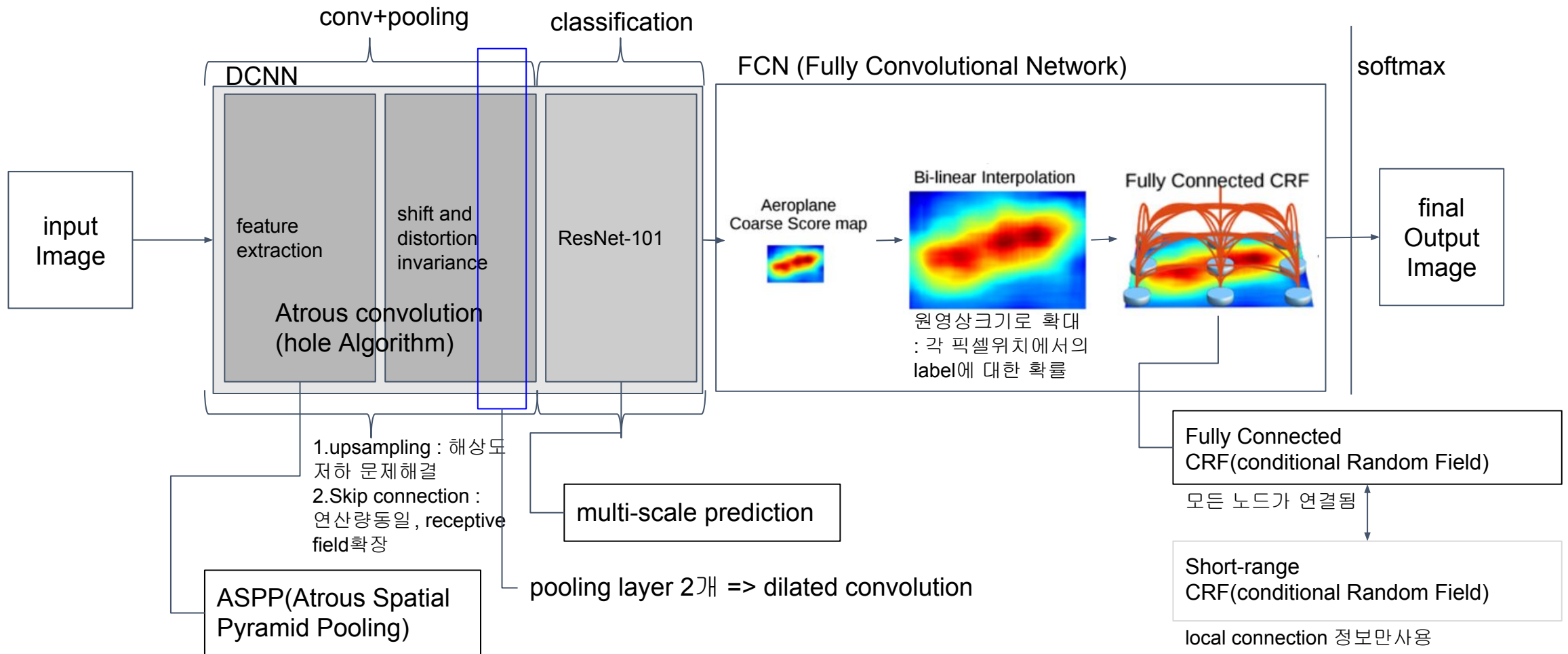
- Image segmentation

에지, 컬러속성 등

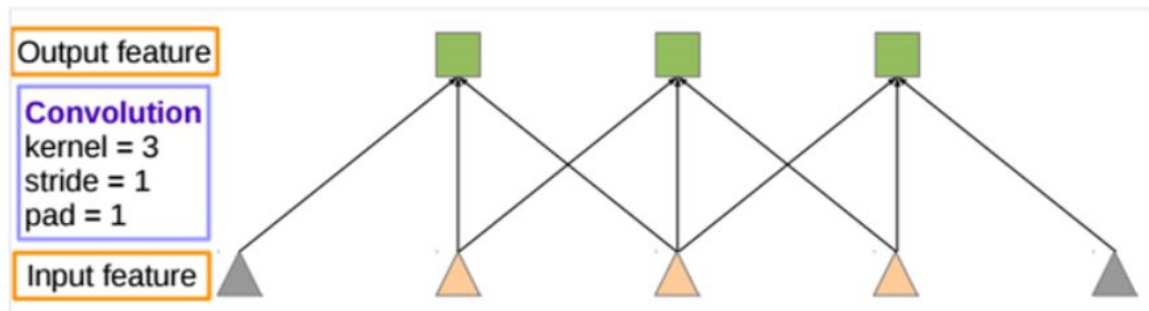
- Semantic segmentation

object class가 포함된 픽셀 단위의 영역

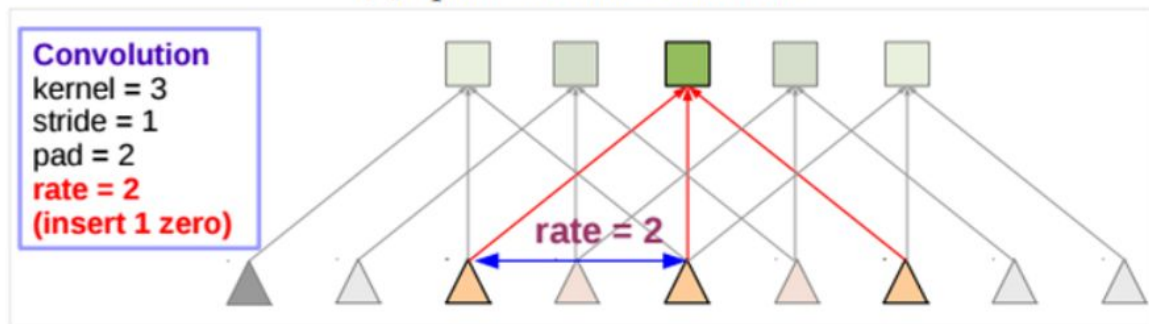
Let's Go Details of DeepLap V2



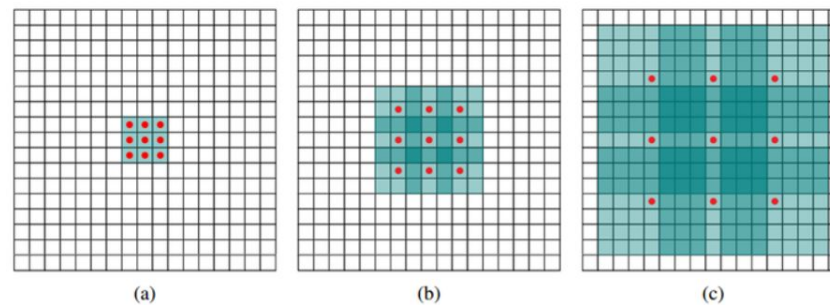
Atrous Convolution



(a) Sparse feature extraction

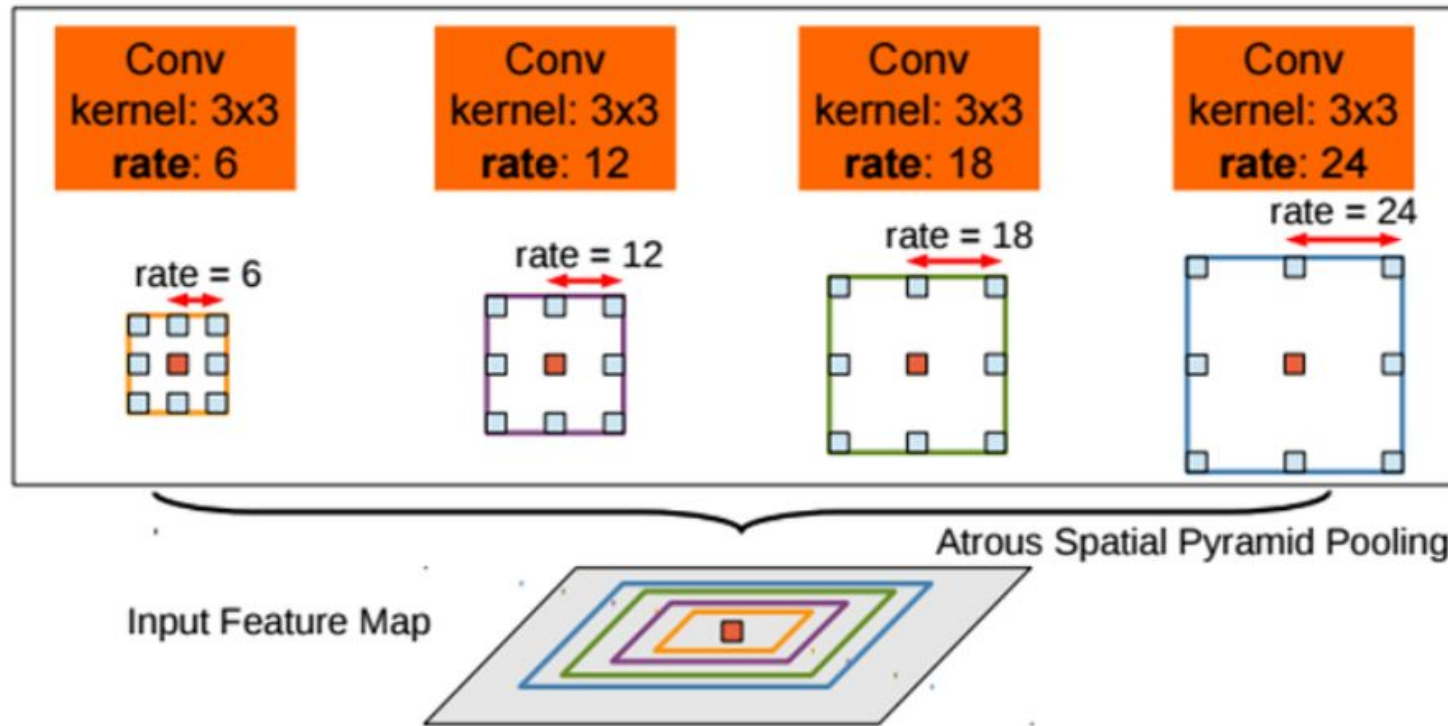


(b) Dense feature extraction



receptive field 증가

ASPP(Atrous Spatial Pyramid Pooling)



CRF(Conditional Random Field)

$$E(\mathbf{x}) = \sum_i \theta_i(x_i) + \sum_{ij} \theta_{ij}(x_i, x_j) \quad \leftarrow \text{Fully connected model}$$

↑ ↑

From DCNN label probabilities Gaussian, pairwise

$$w_1 \exp\left(-\frac{\|p_i - p_j\|^2}{2\sigma_\alpha^2} - \frac{\|I_i - I_j\|^2}{2\sigma_\beta^2}\right) + w_2 \exp\left(-\frac{\|p_i - p_j\|^2}{2\sigma_\gamma^2}\right)$$

↑ ↑

Differences in position and intensity Just position

픽셀값의 유사도 위치적 유사도

\mathbf{x} : 픽셀의 위치에 해당하는 픽셀의 label

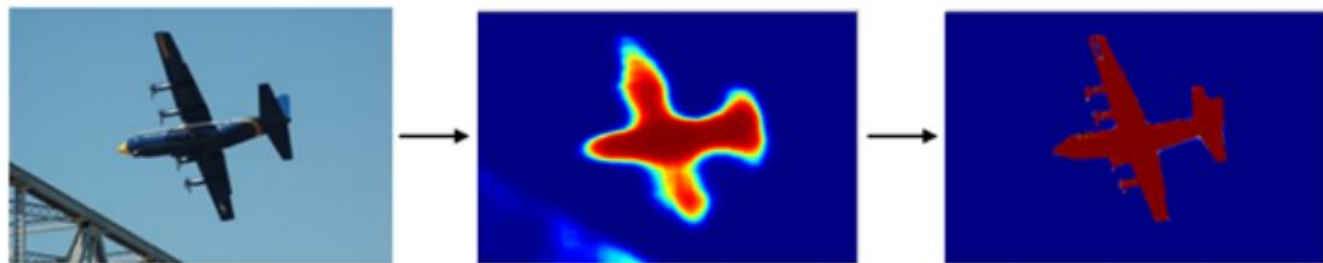
i, j : 픽셀의 위치

σ : 표준편차로 **scale** 조절

I : 픽셀의 컬러값

P : 픽셀의 위치

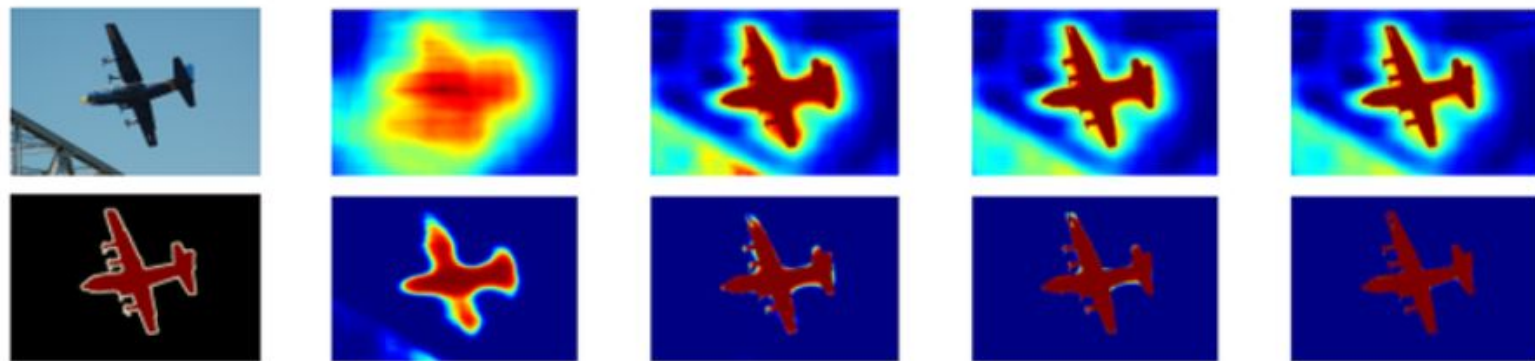
CRF results



image

CNN output

CRF output



Image/G.T.

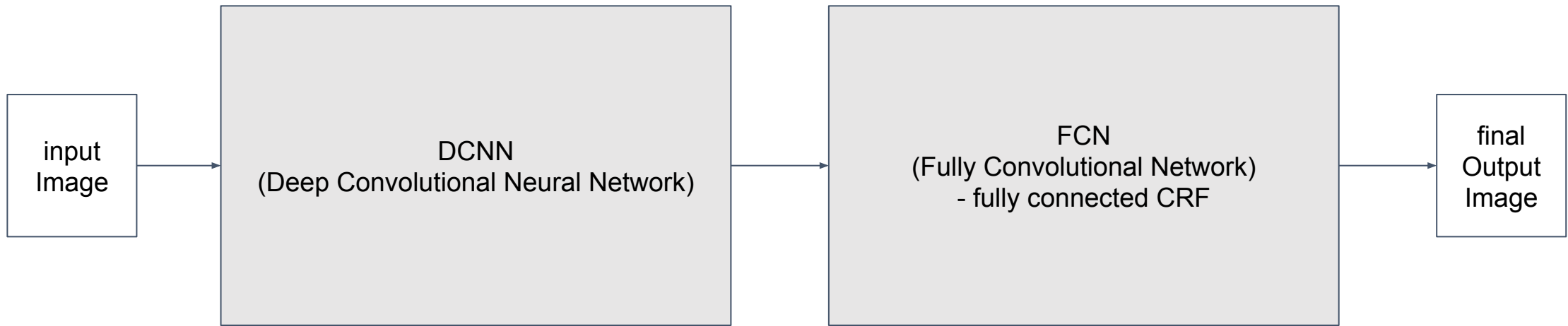
DCNN output

CRF Iteration 1

CRF Iteration 2

CRF Iteration 10

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