1 2 3 4 5 6 7 8 9 0 q w e r t y u I o p a s d f g h j k l z x c v b n m

The banking sector’s capital base strengthened on paper in the second quarter of the year after some banks were allowed to keep their provisioning against default loans in phases.

Besides, some lenders also recovered a good amount of fund from defaulted loans, which has made their capital base stronger than a quarter earlier.

Après quinze ans de carrière, un enseignant français en école primaire gagne 37 700 dollars bruts (34 140 euros) par an, quand son homologue allemand gagne, lui, près du double avec un revenu annuel brut de 74 486 dollars (67 450 euros). C’est l’un des enseignements du dernier rapport annuel "Regards sur l’éducation", publié mardi 10 septembre par l’Organisation de coopération et de développement économiques (OCDE) : en France, les enseignants sont moins payés que leurs homologues des pays membres de l’OCDE.

El mundo de fútbol llora la muerte de Sahar Johadari. Tenía 29 años y falleció a causa de las heridas que sufrió al quemarse a lo bonzo frente al Tribunal Revolucionario donde la juzgaban por haberse intentado colar en un partido del equipo de su alma

774 9062 4430 9398 3980 3313 6564 3480 236 2915 4547 7870 6623 7605 5930 2786 3010 375 3974 4614 2628 2380 7369 654 3088 5689 3427 1506 3253 443 5316 5843 2244 4279 3502 9772 2399 8282 9884 6078 3745 6724 3159 4027 5955 164 5389 5185 941 2266 8269 9012 4942 6991 1627 2712 3830 5975 1746 5838 8435 764 3226 3461 4088 6832 8732 1251 2791 3262 8603 6296 5255 4470 119 1392 2046 7978 4514 8434 4512 2491 4597 4256 888 267 3641 7416 4391 6811 577 1019 8028 5347 2633 6201 5928 5355 8798 743

In this story, DeepLabv3, by Google, is presented. After [DeepLabv1 and DeepLabv2](https://towardsdatascience.com/review-deeplabv1-deeplabv2-atrous-convolution-semantic-segmentation-b51c5fbde92d) are invented, authors tried to RETHINK or restructure the DeepLab architecture and finally come up with a more enhanced DeepLabv3. DeepLabv3 outperforms [DeepLabv1 and DeepLabv2](https://towardsdatascience.com/review-deeplabv1-deeplabv2-atrous-convolution-semantic-segmentation-b51c5fbde92d), even with the post processing step Conditional Random Field (CRF) removed, which is originally used in [DeepLabv1 and DeepLabv2](https://towardsdatascience.com/review-deeplabv1-deeplabv2-atrous-convolution-semantic-segmentation-b51c5fbde92d).

Hence, the paper name is called “Rethinking Atrous Convolution for Semantic Image Segmentation”. It is called “Rethinking …” to companion to the paper name of [Inception v3](https://medium.com/@sh.tsang/review-inception-v3-1st-runner-up-image-classification-in-ilsvrc-2015-17915421f77c), called “Rethinking the Inception Architecture for Computer Vision”, in which [Inception v1 (GoogLeNet)](https://medium.com/coinmonks/paper-review-of-googlenet-inception-v1-winner-of-ilsvlc-2014-image-classification-c2b3565a64e7) and [Inception v2 (Batch Norm)](https://medium.com/@sh.tsang/review-batch-normalization-inception-v2-bn-inception-the-2nd-to-surpass-human-level-18e2d0f56651) are restructured to become [Inception v3](https://medium.com/@sh.tsang/review-inception-v3-1st-runner-up-image-classification-in-ilsvrc-2015-17915421f77c). But right now, [DeepLabv2](https://towardsdatascience.com/review-deeplabv1-deeplabv2-atrous-convolution-semantic-segmentation-b51c5fbde92d) is restructured as DeepLabv3 here. And it is a 2017 arXiv tech report with more than 200 citations. ([Sik Ho Tsang](https://medium.com/u/aff72a0c1243?source=post_page-----6d818bfd1d74----------------------) @ Medium)

# Outline

1. Atrous Convolution
2. Going Deeper with Atrous Convolution Using Multi Grid
3. Atrous Spatial Pyramid Pooling (ASPP)
4. Ablation Study on PASCAL VOC 2012
5. Comparison with State of the art Approaches on PASCAL VOC 2012
6. Comparison with State of the art Approaches on Cityscape

# 1. Atrous Convolution

Atrous Convolution with Different Rates r

Atrous Convolution

* For each location i on the output y and a filter w, atrous convolution is applied over the input feature map x where the atrous rate r corresponds to the stride with which we sample the input signal.
* This is equivalent to convolving the input x with upsampled filters produced by inserting r 1 zeros between two consecutive filter values along each spatial dimension. (trous means holes in English.)
* When r=1, it is standard convolution.
* By adjusting r, we can adaptively modify filter’s field of view.
* It is also called dilated convolution ([DilatedNet](https://towardsdatascience.com/review-dilated-convolution-semantic-segmentation-9d5a5bd768f5)) or Hole Algorithm.

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