U-Net for biomedical image segmentation
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U-Net — proposed by Ronneberger et al. in early 2015 — was the first of its kind deep-neural-network architecture which can segment a wide variety of medical artifacts by training using just a few samples. The paper has over 54K citations and is considered one of the fundamental papers in the bio-medical image segmentation community. U-Net was initially proposed for developing bio-medical image segmentation solutions, but later semantic segmentation and aerial segmentation communities adopted it to solve their tasks, where it was used to segment different classes such as roads, vehicles, landmarks, buildings, etc. The architecture uses bottle-neck layers that capture context and up-sampling layers that help to localize regions of interest in medical images precisely. Data augmentation was the critical aspect used in this paper, which showed that the model surpassed its counterparts by a wide margin during its time, using a smaller number of samples during training. U-Nets are still used in many medical image segmentation applications and are compared against newly proposed methods as a benchmarking test, which are generally derived from the basic principles and philosophy of the design of U-Net architecture. Still to this date, after the development of U-Net, the architecture is still used to win competitions in the medical image segmentation community, by adding new modifications. ResUNet, ResUNet++, Attention U-Net, R2U-Net, Modified U-Net, BMSAN, Attention R2U-Net, MultiResUNet, etc. are all derivatives of U-Net which improves the performance of U-Net by a small margin.