Helpful Hints for Using Deep Learning Image Reconstruction

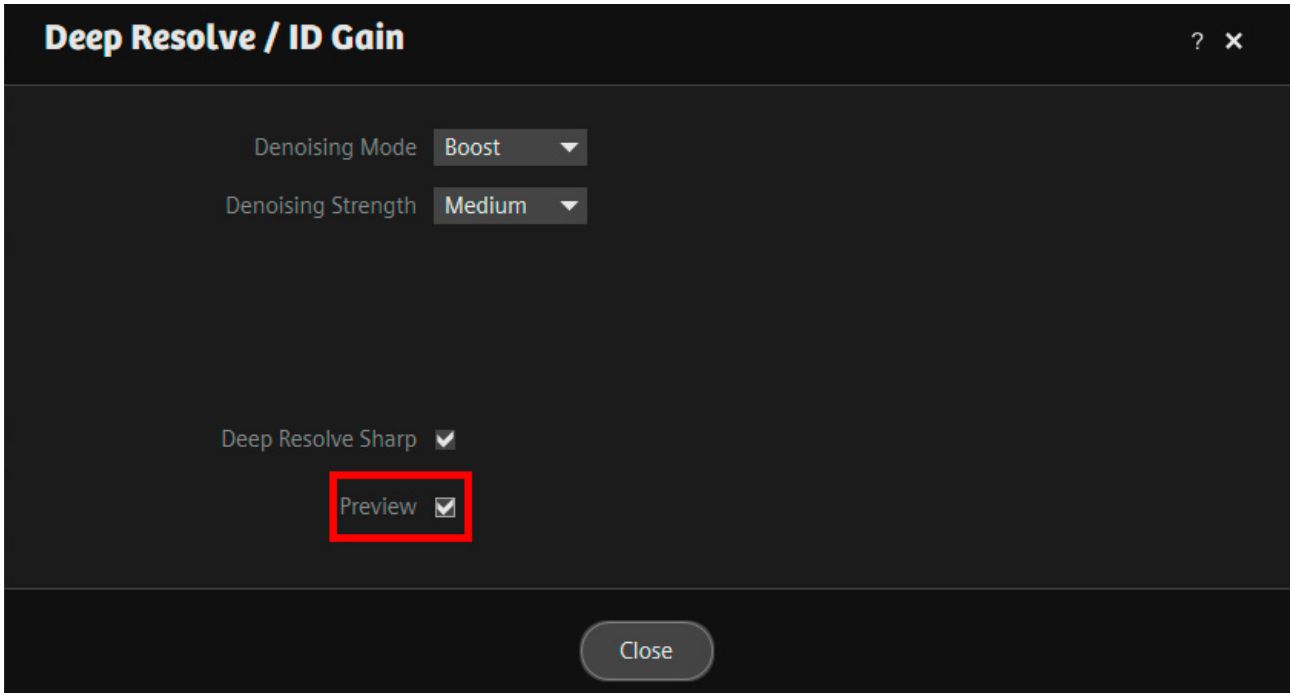
Mario Zeller, Ph.D.

Siemens Healthineers, Erlangen, Germany

Deep Resolve Boost can perform parallel imaging reconstructions with an improved signal-to-noise ratio. This means it can potentially reduce scan times more than conventional parallel imaging algorithms, such as GRAPPA.

Deep Resolve Boost was trained to denoise data. However, it also has built-in data consistency constraints, which force it to be consistent with the acquired raw data. To achieve both denoising and consistency, it tends to smooth regions that would be very noisy with conventional imaging methods. This smooth image impression can be misleading to radiologists and technologists who have been trained on conventional imaging methods.

To address this issue when setting up new protocols, we provide a preview function (starting from *syngo* MR XB10A), which can be activated in the Deep Resolve sub-dialog box (Fig. 1).



1 You can activate the preview option in the Deep Resolve sub-dialog box.

The preview option triggers a conventional GRAPPA/CAIPIRINHA parallel imaging reconstruction (Fig. 2A) before the Deep Resolve Boost reconstruction (Fig. 2B).

This allows you to better judge whether the chosen parameters are reasonable.

The following table offers some helpful hints on which imaging parameters affect SNR as SNR is a primary indicator for good performance of Deep Resolve Boost.

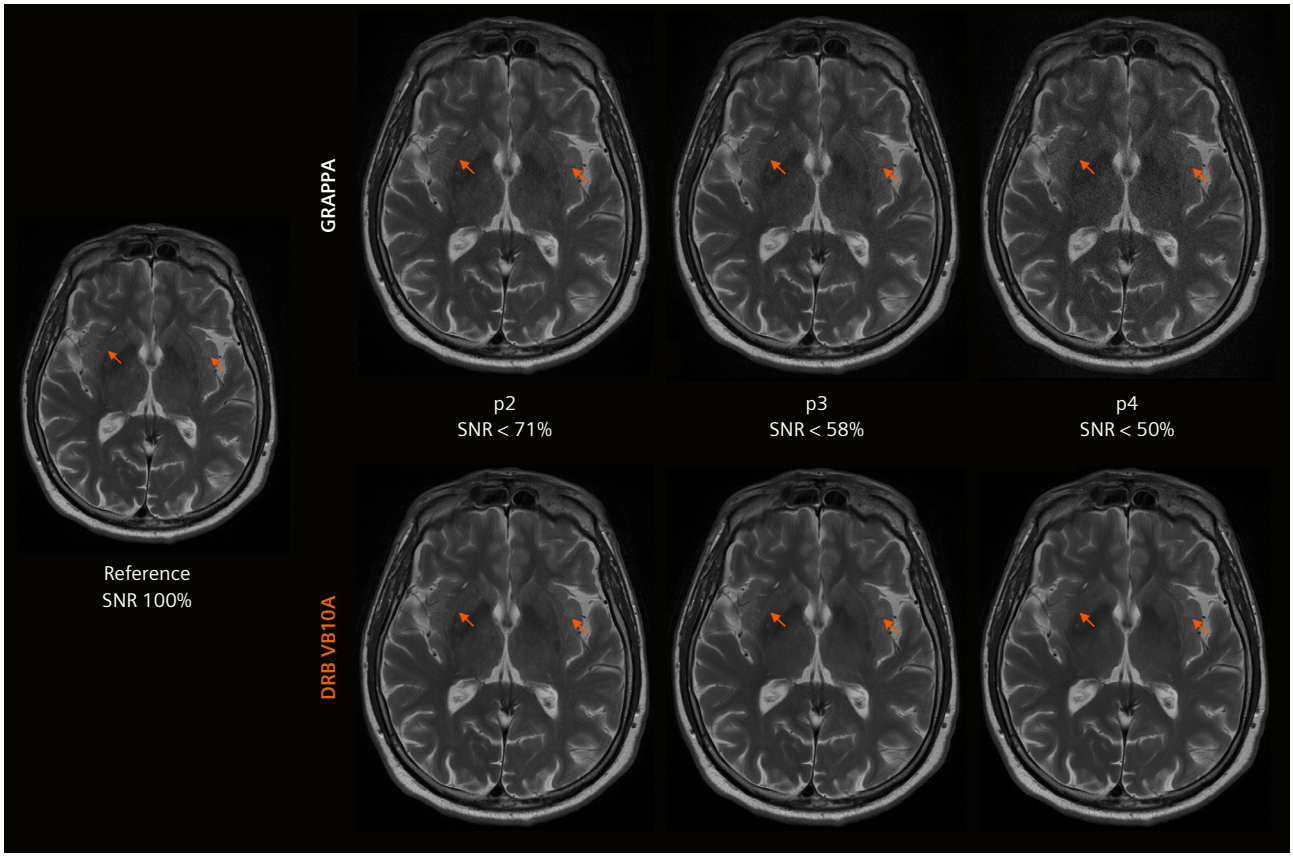
2 Two image series produced by the preview option. **(2A)** Conventional parallel imaging reconstruction. **(2B)** Deep Resolve Boost reconstruction. The preview series has the suffix "_Preview." Would you still feel confident making a clinical decision using the preview series? If not, the settings are probably too ambitious.

Action	Relative SNR
Decreasing slice thickness from 2 mm to 1 mm	0.5
Decreasing averages from 4 to 1 (i.e. reducing measurement time by 75%)	0.5
Increasing PAT acceleration factor from 1 to 4	0.5
Doubling base resolution (e.g., from 320 to 640) while keeping phase resolution at 100%	0.35
Doubling base resolution (e.g., from 320 to 640) while keeping phase resolution at 50%	0.5
(Relative SNR indicates the SNR ratio as compared with the unmodified protocol. A relative SNR of 0.5 corresponds to 50% less SNR)	

Table 1: Which imaging parameters affect SNR.

Starting with insufficient SNR may cause a loss of image features, as you can see in Figure 3. SNR can also be reduced at high acceleration factors due to the coil geometry. You can check the relative change in SNR in the top right corner of the protocol dialog.

To learn more, please refer to the **Deep learning image reconstruction** chapter in your **Diagnostic MR Imaging Operator Manual.**



3 When the relative SNR is too low, image features can not be fully recovered.