Appendix

A Slice Gap Interpolation Method

\[ SG = 1 \]

\begin{align*}
F(i+1, j+1) = \frac{1}{4} (f(i-1, j) + f(i+1, j) + f(i, j+1) + f(i, j-1))
\end{align*}

End A

For the combination of two LR images of 1x(1+SG) and (1+SG)x1 (SG=2) and the interpolation is based on three neighbors (IDW) for four points in one pass yielding 1x1 and SG=0 HR image (Fig. 6, row 2). Alternatively, three techniques can be used: NN for one point, NN average of three points and IDW excluding the corners (IDW NC) (i.e. average of two points), the latter being the method chosen to extend to 3-D.

\[ SG = 2 \]

\begin{align*}
F(i+1, j+1) = \frac{1}{3} \left( f(i+1, j) + f(i, j+1) + \frac{f(i,j)}{\sqrt{2}} \right) \\
F(i-1, j+1) = \frac{1}{3} \left( f(i-1, j) + f(i, j+1) + \frac{f(i,j)}{\sqrt{2}} \right) \\
F(i+1, j-1) = \frac{1}{3} \left( f(i+1, j) + f(i, j-1) + \frac{f(i,j)}{\sqrt{2}} \right) \\
F(i-1, j-1) = \frac{1}{3} \left( f(i-1, j) + f(i, j-1) + \frac{f(i,j)}{\sqrt{2}} \right)
\end{align*}

End B

Three interpolation passes are required for a 1x(1+SG) and (1+SG)x1 (SG=3) set of LR images where each pass fills in four points simultaneously. First an interpolation based on three neighbors (IDW) is performed; the interpolation based on the next three nearest neighbors is performed; finally the interpolation based on 1x(1+SG) (SG=1) dimension scheme is repeated (Fig. 6). The three alternative techniques are repeated here with the addition of modifying the 1x(1+SG) (SG=1) scheme to include eight points.

\[ SG = 3 \]

1\textsuperscript{st} pass: repeat SG=2 scheme, B

2\textsuperscript{nd} pass:

\begin{align*}
F(i+2, j+1) = \frac{1}{4} \left( f(i+2, j) + f(i+1, j+1) + f(i-1, j+1) \right) \\
F(i-1, j+2) = \frac{1}{4} \left( f(i, j+2) + f(i-1, j+1) + f(i-1, j+1) \right) \\
F(i+2, j-1) = \frac{1}{4} \left( f(i+2, j) + f(i+1, j-1) + f(i-1, j-1) \right) \\
F(i+1, j+2) = \frac{1}{4} \left( f(i, j+2) + f(i+1, j+1) + f(i+1, j+1) \right)
\end{align*}

End C

3\textsuperscript{rd} pass: repeat SG=1 scheme (incremented), A

Three interpolation passes are required for a 1x(1+SG) and (1+SG)x1 (SG=4) set of LR images where the second pass fills in eight points. The first
pass is an interpolation based on three neighbors (IDW). This is followed by another interpolation based on three neighbors (IDW). Finally the third pass follows the 1x(1+SG) (SG=2) interpolation scheme (Fig. 6). For comparison the three alternative techniques from above are also implemented. This iterative approach is expanded to 1x(1+SG) (SG=5), can be extended to other dimensions, and is dependent on the difference between the low and high dimensions, i.e. slice gaps. The alternative interpolation methods and points used were for efficiency evaluation and comparison in 2-D. The most efficient was then chosen for expansion to 3-D. The above process was expanded and repeated for 3-D with an additional LR volume, Fig. 7. Next this algorithm was simulated using phantoms and tested using real data. Note, in the case of SG=0 the pixels/voxels are averaged.

\[ SG = 4 \]

\[ 1^{st} \text{ pass: repeat SG}=2 \text{ scheme, B} \]
\[ 2^{nd} \text{ pass:} \]

\[
\begin{align*}
F(i + 1, j + 2) &= \frac{1}{3} \left( f(i + 1, j + 1) + f(i, j + 2) + f(i + 1, j + 1) \right) \\
F(i + 2, j + 1) &= \frac{1}{3} \left( f(i + 2, j) + f(i + 1, j + 1) + f(i + 1, j + 1) \right) \\
F(i - 1, j + 2) &= \frac{1}{3} \left( f(i - 1, j + 1) + f(i, j + 2) + f(i, j + 2) \right) \\
F(i - 2, j + 1) &= \frac{1}{3} \left( f(i - 2, j) + f(i - 1, j + 1) + f(i, j + 2) \right) \\
F(i - 2, j - 1) &= \frac{1}{3} \left( f(i - 2, j) + f(i - 1, j - 1) + f(i, j - 1) \right) \\
F(i - 1, j - 2) &= \frac{1}{3} \left( f(i - 1, j - 1) + f(i, j - 2) + f(i, j - 2) \right) \\
F(i + 1, j - 2) &= \frac{1}{3} \left( f(i + 1, j - 1) + f(i, j - 2) + f(i, j - 2) \right) \\
F(i + 2, j - 1) &= \frac{1}{3} \left( f(i + 2, j) + f(i + 1, j - 1) + f(i, j - 1) \right) \\
\end{align*}
\]

\[ 3^{rd} \text{ pass: repeat SG}=2 \text{ scheme (incremented), B} \]