Investigation of Low Precision Sample-Rate Conversion Algorithm for Machine Learning Applications

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Resampling

• Signal processing tool
• Changes the number of samples in a signal
• Used in machine learning
Upsampling (zero order hold)

Input vector:

\[1 \ 2 \ 3 \ 4 \ 5]\n
Output vector with upsample factor of 2:

\[1 \ 0 \ 2 \ 0 \ 3 \ 0 \ 4 \ 0 \ 5 \ 0\] \rightarrow \[1 \ 1 \ 2 \ 2 \ 3 \ 3 \ 4 \ 4 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \]

Output vector with upsample factor of 5:

\[1 \ 0 \ 0 \ 0 \ 0 \ 2 \ 0 \ 0 \ 0 \ 0 \ 3 \ 0 \ 0 \ 0 \ 0 \ 4 \ 0 \ 0 \ 0 \ 0 \ 5 \ 0 \ 0 \ 0 \ 0 \ 0 \]

\rightarrow \[1 \ 1 \ 1 \ 1 \ 1 \ 2 \ 2 \ 2 \ 2 \ 2 \ 3 \ 3 \ 3 \ 3 \ 3 \ 3 \ 3 \ 3 \ 4 \ 4 \ 4 \ 4 \ 4 \ 4 \ 4 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \ 5 \]
Downsampling

Input vector:

[1 2 3 4 5 6 7 8 9 10]

Output vector with downsample factor of 2:

[1 3 5 7 9]

Output vector with downsample factor of 4:

[1 5 9]
Motivation

- Minimise the value of the LCM required to reduce computation time
- 32 -> keep the same number of samples
- 35 -> discard 3 samples
- 30 -> add 2 samples of zero value
- Zero padding and discarding sample values are permitted because the image signal is noisy
Project Aim

To implement the new algorithm and zero order hold in C and compare their performance against each other.
Conclusion

• Resampling is an intensive task if done to a high precision
• A noisy image does not require high precision
• Our algorithm aims to sacrifice precision for faster speed