Vectorized Logical Operations

Vectorized code to support plotting

\[ f(x) = \frac{\sin(5x) \exp(-x/2)}{1 + x^2} \]

for \(-2 \leq x \leq 3\)

\[ x = \text{linspace}(-2,3,200); \]
\[ y = \sin(5x) \cdot \exp(-x/2) \cdot (1 + x^2); \]
\[ \text{plot}(x,y) \]

Element-by-element arithmetic operations on arrays

Zeroing out values below a threshold

\[ y = \ldots \quad \% \text{ sound data} \]
\[ T = 0.08; \quad \% \text{ threshold} \]
\[ \text{for } k = 1: \text{length}(y) \]
\[ \quad \text{if } \text{abs}(y(k)) < T \]
\[ \quad \quad y(k) = 0; \]
\[ \quad \text{end} \]
\[ \text{end} \]
\[ y = y \cdot \text{abs}(y) > T; \]

vectorized version

Extracting values from a vector

\[ v = [-2 17 3 12 11 3 4 2 0 11 4 12 -2 9] \]

Extract all the values in (-1,10)

\[ w = []; \]
\[ \text{for } k = 1: \text{length}(v) \]
\[ \quad \text{if } v(k) > -1 \& \& v(k) < 10 \]
\[ \quad \quad w = [w \ v(k)]; \]
\[ \quad \text{end} \]
\[ \text{end} \]

vectorized version

\[ w = v( v>-1 \& v<10 ); \]

Extract all the values in (-1,10)

\[ w = v( v>-1 \& v<10 ); \]

vectorized version

\[ [0 0 1 1 0 1 1 0 1 1 1 1 0 1 1] \]
Extracting values from a vector

\[ v = \begin{bmatrix} 2 & 17 & 3 & 12 & 11 & 3 & 4 & 2 & 2 & 0 & 3 & 1 & 4 & 12 & 2 & 9 \end{bmatrix} \]

Extract all the values in (-1,10)

\[
\begin{align*}
v &= v( v > -1 \& v < 10 ); \\
v &= v;
\end{align*}
\]

Indices (positive integers) go here ... usually.

If these were plain (numeric) 0s and 1s, then this would not work! BUT these 0s and 1s come from logical operations, and therefore have the logical property.

Matlab allows the use of logical values instead of indices for accessing particular cells in a vector. The length of the logical array must be the same as the length of the vector.

Extracting values from a matrix

\[ m = \begin{bmatrix} 3 & 4 & -2 & 2 & 0 \\
0.1 & 17 & 3 & 12 & 11 \\
3.1 & 4 & -12 & -2 & 9 \\
-9 & -1.1 & -3 & 0 & 8 \end{bmatrix} \]

Extract all the values in (1,10)

\[
\begin{align*}
w &= m( m > 1 \& m < 10 ); \\
w &= \begin{bmatrix} 3 \ 1 \ 4 \ 3 \ 9 \ 8 \end{bmatrix}
\end{align*}
\]

Bitwise (non-short-circuiting) operator