Noise in images can be removed by blurring. To preserve edges a conductivity term is introduced, monotonically decreasing with gradient strength. The non-linear diffusion equation is numerically solved by forward Euler approximation.

The isotropic linear diffusion equation for an image \( L \) is given by:
\[
\frac{\partial L}{\partial s} = \nabla \cdot \nabla L
\]

The introduction of a conductivity coefficient \( c \) in the diffusion equation makes it possible to make the diffusion adaptive to local image structure [3] (Perona & Malik scheme [1]):
\[
\frac{\partial L}{\partial s} = \nabla \cdot (c \nabla L)
\]

The edges are well preserved:

Image derivatives are implemented as convolutions by Gaussian derivative kernels, making up for robust multi-scale differential operators [4].

Alvarez [2] proposed the parameter-free Euclidean shortening flow:
\[
\frac{\partial L}{\partial s} = \nabla L \cdot \nabla \left( \frac{\nabla L}{|\nabla L|^2} \right)
\]

The numerical implementation is solved by forward-Euler iteration:

```
eucideanshortening [imt, nrsteps, c, evolutionrange] := Module[{im = imt, steps = evolutionrange / nrsteps; imt = im;}
Do[imt += c \nabla L[imt, 0, 2, \sigma] \nabla L[imt, 1, 0, \sigma]^2 - 2 \nabla L[imt, 1, 0, \sigma] \nabla L[imt, 1, 1, \sigma] 2 \nabla L[imt, 2, 0, \sigma]/(\nabla L[imt, 0, 1, \sigma]^2 + \nabla L[imt, 1, 0, \sigma]^2), {nrsteps}]; imt;]
```

Euclidean shortening flow to remove ultrasound speckle noise (from [4]).