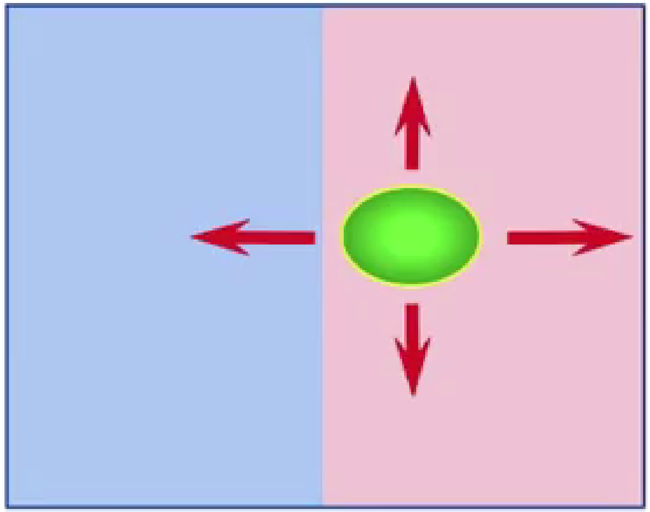
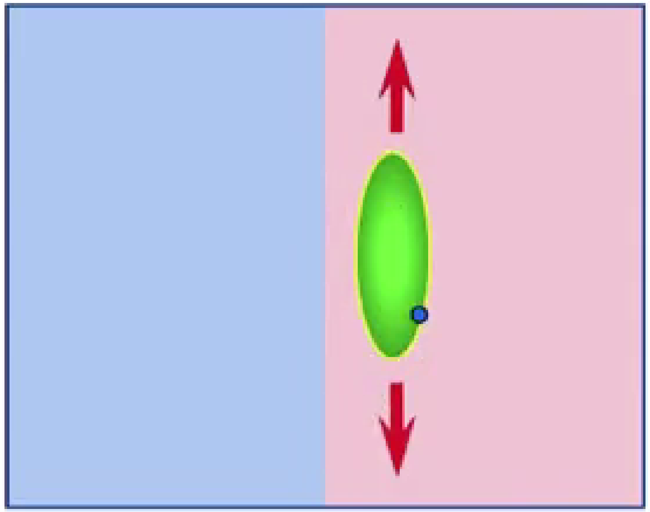
Anisotropic diffusion

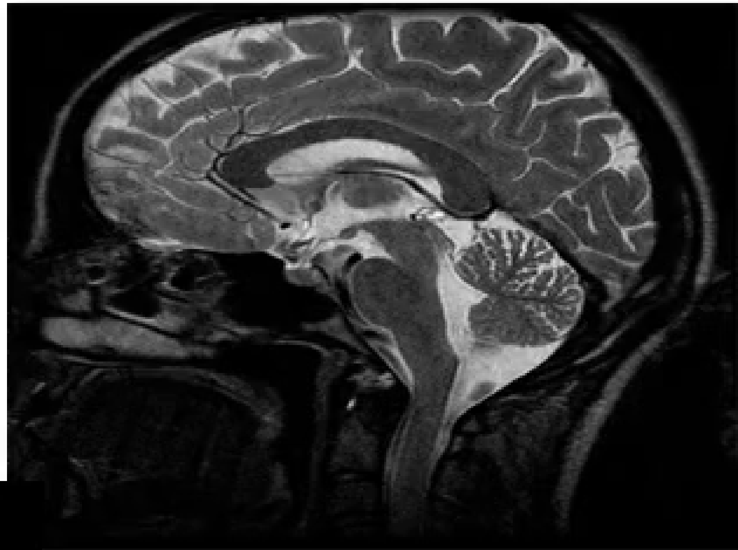
Isotropic vs. Anisotropic Smoothing

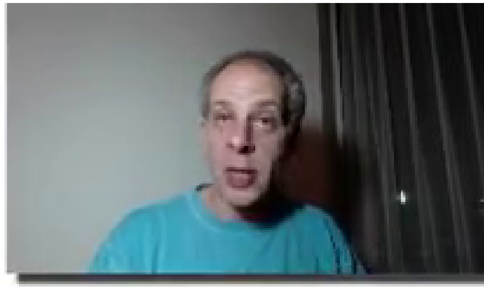


Isotropic smoothing



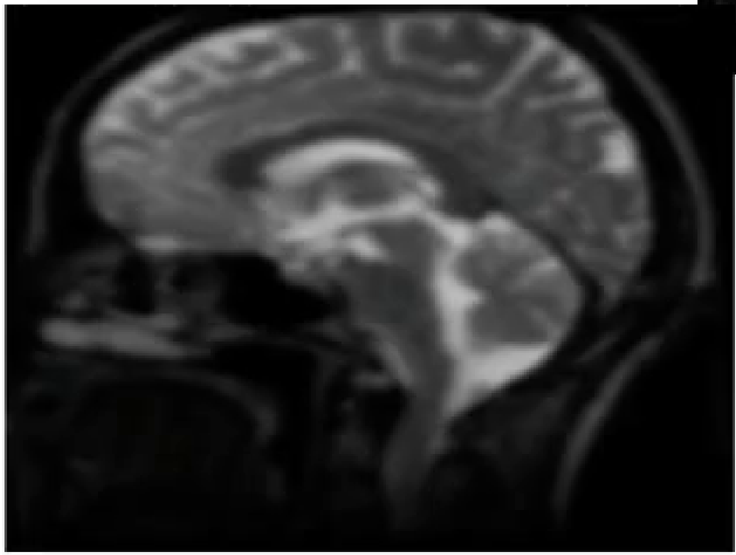
Anisotropic smoothing

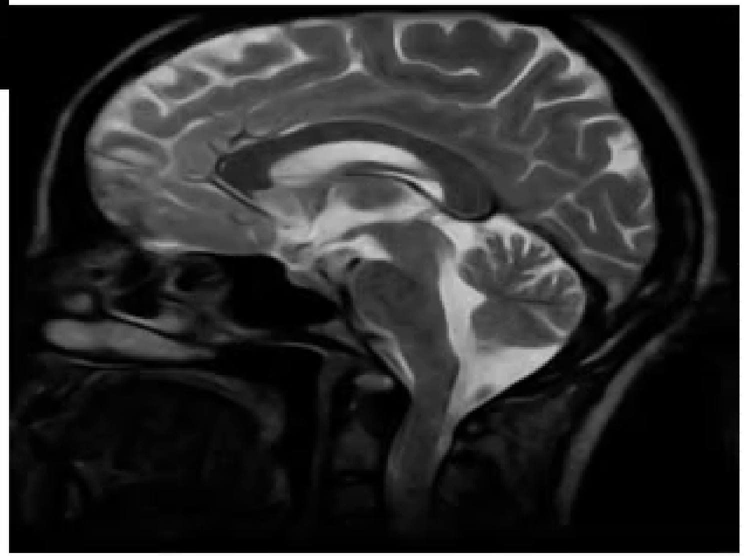




Isotropic
(Heat equation)

Anisotropic





$$\Delta I = div(g \nabla I)$$

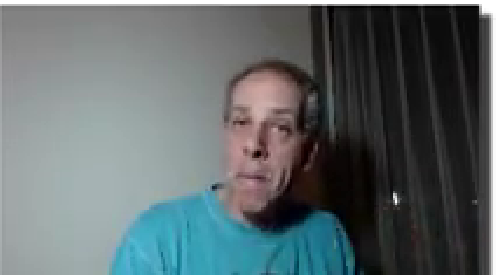
∂

$$\frac{\partial I(x,y,t)}{\partial t} = \Delta I$$

$$\frac{\partial I(x,y,t)}{\partial t} = div(g(|\nabla I|)\nabla I)$$

$$\min_I \int_\Omega \rho(|\nabla I|)\, d\Omega \quad \Rightarrow \quad \frac{\partial I(x,y,t)}{\partial t} = div\left(\rho' \frac{\nabla I}{|\nabla I|}\right)$$

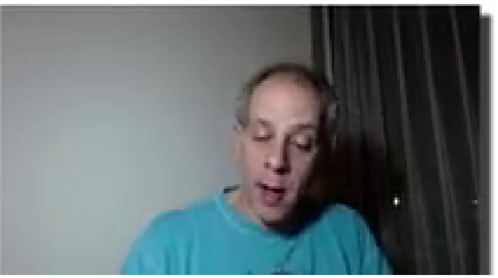
$$\int F(u, u_x)$$



$$\min_I \int_\Omega \rho(|\nabla I|)\, d\Omega \quad \Rightarrow \quad \frac{\partial I(x,y,t)}{\partial t} = div\left(\rho' \frac{\nabla I}{|\nabla I|}\right)$$

$$\rho(a) = a^2 \qquad \rho' = 2a$$

$$\int |\nabla I|^2 \qquad I_t = div\left(\overbrace{|\nabla I|}^{\rho'} \frac{\nabla I}{|\nabla I|}\right)$$



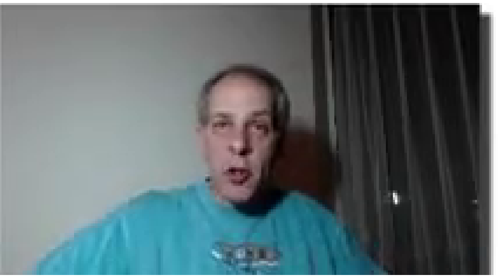
$$\min_I \int_\Omega \rho(|\nabla I|)\, d\Omega \quad \Rightarrow \quad \frac{\partial I(x,y,t)}{\partial t} = div\left(\rho' \frac{\nabla I}{|\nabla I|}\right)$$

$$\rho(a) = a^2 \qquad \rho' = 2a$$

$$\int |\nabla I|^2$$

$$I_t = div\left(\overbrace{\cancel{|\nabla I|}}^{\rho'} \frac{\nabla I}{\cancel{|\nabla I|}}\right)$$

$$= \Delta I$$



$$\min_I \int_\Omega \rho(|\nabla I|)\,d\Omega \Rightarrow \frac{\partial I(x,y,t)}{\partial t} = div\left(\rho' \frac{\nabla I}{|\nabla I|}\right)$$

$\rho(a) = a \Rightarrow \rho' = 1$ Total Variation

$$\int |\nabla I| \qquad I_t = div\left(\frac{\nabla I}{|\nabla I|}\right)$$