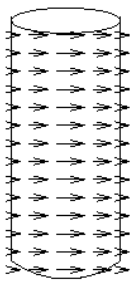
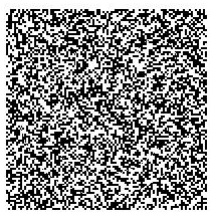
Analysis of Motion

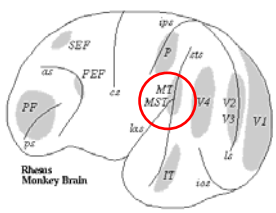
Measuring image motion

CS332 Visual Processing
Department of Computer Science
Wellesley College

Analysis of visual motion



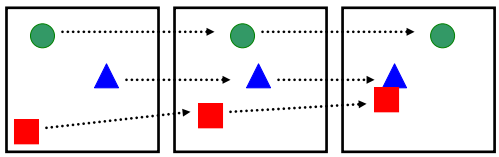




Representations of image motion

(1) velocity field

(2) correspondence



Human visual system:

(1) short-range motion process

(2) long-range motion process

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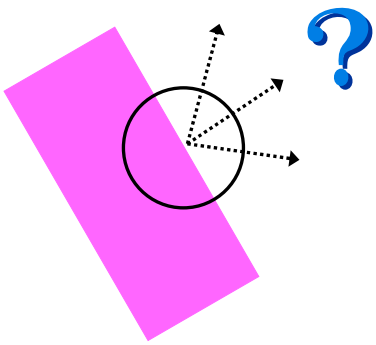
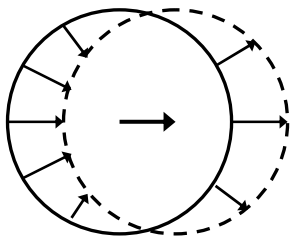
Aperture problem





"local" motion detectors provide only one component of motion, in the direction perpendicular to a moving edge

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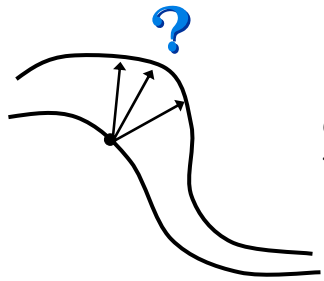
To make matters worse…



2D velocity field is not determined uniquely from the changing image

We need *additional constraint* to compute a unique velocity field

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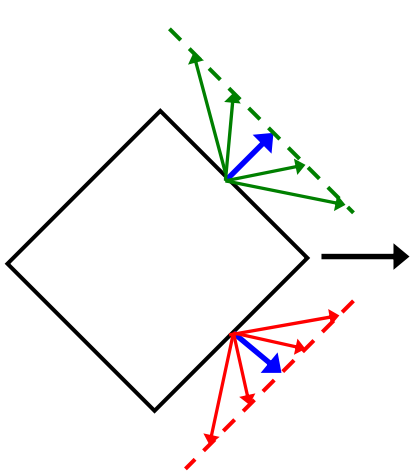
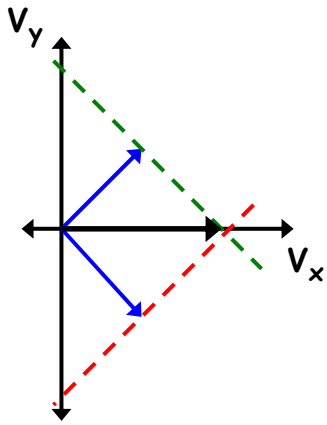
Assume *pure translation*





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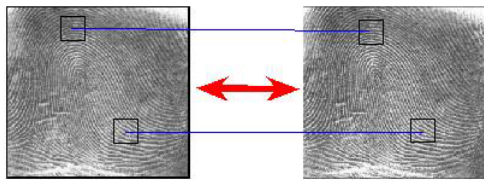

mystery Sohie!

motion measurement strategy!

CS ROCKS!

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Practical considerations for methods based on pure translation:

- Error in initial motion measurements
- Velocities not constant locally
- Local image features may have small range of orientations

But… such strategies are good for

- detecting sudden movements
- tracking
- detecting boundaries

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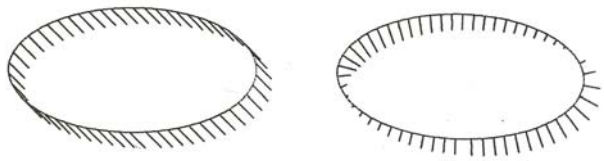
Smoothness assumption:

Compute a velocity field that:

(1) is consistent with local measurements of image motion (perpendicular components)

(2) has the *least amount of variation* possible

Pure Translation:



true & smoothest velocity field

initial motion measurements

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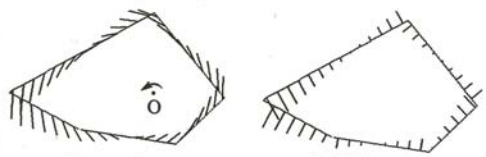
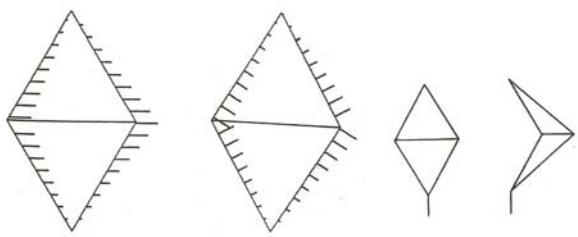
When is the smoothest velocity field *correct?*

Rotation of rigid objects in 2D and 3D:



true & smoothest velocity field

initial motion measurements



true & smoothest velocity field

initial motion measurements

kinetic depth effect
Wallach & O'Connell

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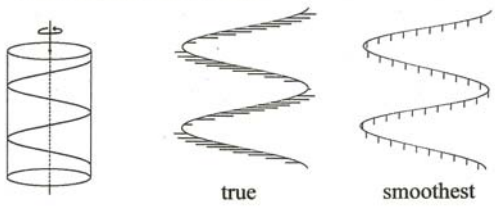
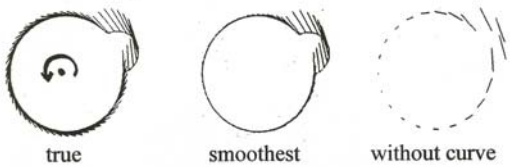
When is the smoothest velocity field *wrong?*

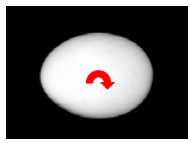
barberpole illusion:



"white egg" illusion



rotating spiral



but so are we…

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