We present a flexible, distributed and effective technique to model custom distortions of images.

The idea consists of using a mesh of springs representing the image plane. We set up a grid of particles where neighboring particles are connected through springs, exerting forces onto each other. Distortions are created by changing the rest-lengths of the springs and calculating the resulting displacements.

### Modified spring force:
- traditional spring-model: only depends on deflection → unstable, mesh can fold back
- better: use displacement from rest-position → preserves spatial relationships between particles

### Damping:
- damping terms for absolute and relative (w.r.t. neighbors) velocities
- keeps the displacements local and prevents the system from oscillating

### Distorting 3D scenes:
- magnify selected objects using object-ID
- integrated in interactive labeling-application: magnification provides more space for labels
- object follows magnification

SpringLens provides an intuitive interface for the user to interactively design complex distortions.

### Data Driven
Due to the distributed nature of SpringLens, it is very easy to incorporate data-driven distortion. Instead of user-interaction, data-attributes are used to determine the region to be magnified.

### Data-driven Distortion
- use image data (here: object-ID)
- select object-ID to be magnified
- enlarge springs at particles with matching object-ID
- spring-mesh implicitly works out distortion

SpringLens provides a flexible technique to create complex nonlinear magnifications. Due to its distributed nature, it allows for data-driven distortion.

### Previous approaches:
- predefined magnification function
- perspective projection
- problems with complex distortions

### Nonlinear magnifications:
- magnify interesting regions in images, but preserve context
- in this work: interactively and intuitively model the required distortions

### Features:
- simple and effective
- distributed paradigm → self-organizing distortion
- animated distortions, evolve smoothly
- physical look and feel, comprehensible distortions

### Limitations:
- fixed resolution of spring-mesh
- very small details cannot be magnified
- bitmap-based rendering
- big magnifications lead to aliasing

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