Differential invariant signatures for planar Lie group transformations of images

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1 Introduction

1.1 Invariants, hey!

literature (Cartan, Olver, Russians, Draisma), motivation, etc,

1.2 Invariants for images

Colour and the lack of independence. Fractal dimension

Calculating derivatives (discussion on desirability thereof). Euclidean-invariant smoothing is a thing, other groups not so much.

1.3 Introducing the cast

Define each group, mesh image of what transformations can look like

1.4 Technical wank

Completeness, degeneracy, moving frames as concept, table of numbers of derivatives, all that jazz, maybe scaling technique for dealing with invariants of non-unit weight

2 The invariants

One subsection for each group. Mathematical details/theorem/derivation, no examples

2.1 SA(2), E(2), SE(2), and Sim(2), or some better title

Theorem 1. *SA(2) invariants up to second order are: I0, I1, I2 from Jupyter document*

Corollary for E(2), SE(2), R2 and Sim(2)

Commentary on geometric interpretation of these things.

2.2 A(2)

Theorem 2. *General affine invariants using transvectants*

Relative invariants and weights go here? probably

2.3 Möbius and Projective (finite dimensional)

Theorem 3. *Moving frame invariants for Möbius*

Theorem 4. *Moving frame invariants for Projective*

2.4 Infinite dimensional diff groups (diff con, diff vol, diff)

3 Computational examples

General idea of what we've done. Experiment to compare e.g. SA(2) and Sim(2). Contrast between intuitive notion of complexity (described by number of parameters in group) versus reality.

3.1 Examples of all of 'em

Big matrix of pictures for comparison purposes

3.2 Hat tip to practicality: smoothing for E(2) and subgroups thereof

Allows these groups to be used on real (i.e. not particularly differentiable) images

3.3 colour

4 Discussion and Conclusion or whatever

Why are we using invariants? This idea is extremely local, can global information be better utilised? Relation to using more computationally tractable e.g. SA(2) not E(2) Comparison with other invariant forms - e.g. Fourier, integral, etc.

4.1 Future work

Can we do better with the weights? Can we do better with derivatives? Projection onto Riemann sphere? Noise. Ugh.