Motion Priors for Pose Estimation and Animation Workflows

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Abstract

TODO

Zusammenfassung

TODO: translate to German

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Introduction

Introduction

- Existing pipeline description - 2d keypoints - 3d keypoints - Optimisation of cameras, ground plane, etc. - Existing pipeline problems - Robustness - Investigation: Motion Priors - Use for plausible motion

Related Work

This section describes references

2.1. Pose Estimation

The existing pipeline for 2D pose estimation is based on Open Pose [CHS+19].

2.2. Motion Priors

The authors of HuMoR [RBH+21] presented a novel approach for learning and using a plausible motion prior. They train a conditional VAE that learns a distribution over latent transitions, in a canonical reference frame, between states that consist of a root translation, joint positions, joint angles, and the respective velocities. They (primarily?) use this model as a prior in a 'test time optimisation', which generates plausible sequence motions optimising for an initial state and a sequence of transitions starting from frame by frame estimates (2D/3D joints or points clouds). This optimisation includes, alongside others, a motion prior term based upon the conditional distribution $p(z_t|x_{t-1})$ that encourages plausible motion for the learned sequence. Note that the CVAE decoder also predicts ground plan contact alongside change in state, which are used in regularisers during their main use case 'test time optimisation'.

HuMoR discussions:

- They consider extending the method to include body shape parameters in the state an important direction for improved generalisation.
- They claim normalising flows and neural ODEs show potential but they only link to pa-

pers explaining these concepts and not actually using them for this purpose so not sure (Normalising flow: map to a simple distribution with an invertible function => tractable marginal likelihood (unlike with VAEs where we have to deal with an ELBO), but I'm not sure we care about the marginal likelihood in this case)

- 'MVAE' does not work well
- The SMPL regularisation and the learned contional prior are important during training
- Assumptions:
  - The method necessitates knowledge of the ground plane, which is presently needed (empirical observation) for convergence during training (as the dataset is of motions with a flat ground), and thus also at test time even though it is not conceptually necessary
  - Assumes static camera
- Limitations:
  - Single person formulation

The authors of HuMoR [RBH+21] were inspired by the Motion VAE [**?**] paper. This paper uses an Conditional VAE (with assumed standard normal prior conditioning (vs. NN in HuMoR)) that directly outputs the next state (rather than the change in state in HuMoR). The model is used Autoregressively to predict motion (rather than the main presented use of HuMoR which is to fit motion to a sequence of existing 2D/3D joint predictions, though HuMoR can equally well be used autoregressively), and is trained with the typical ELBO. Some notes to self about MotionVAE

- MotionVAE is used with Deep RL with the action space taken to be the latent space of the CVAE, with a reward function that defines goals of a character, the control policy walks through the actions space to guide the generative model in accordance with these goals. Could be interesting for interactive character animation
- Contains a nice overview of motion prediction methods

Your Central Work

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3.1. First Section

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1TL	Zucker
1TL	Salz
	lauwarmes Wasser

Table 3.1.: *Flammkuchenteig. The ingredients have to be carefully chosen.*

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3.1.1. Fist Subsection

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3.1.2. Another Subsection

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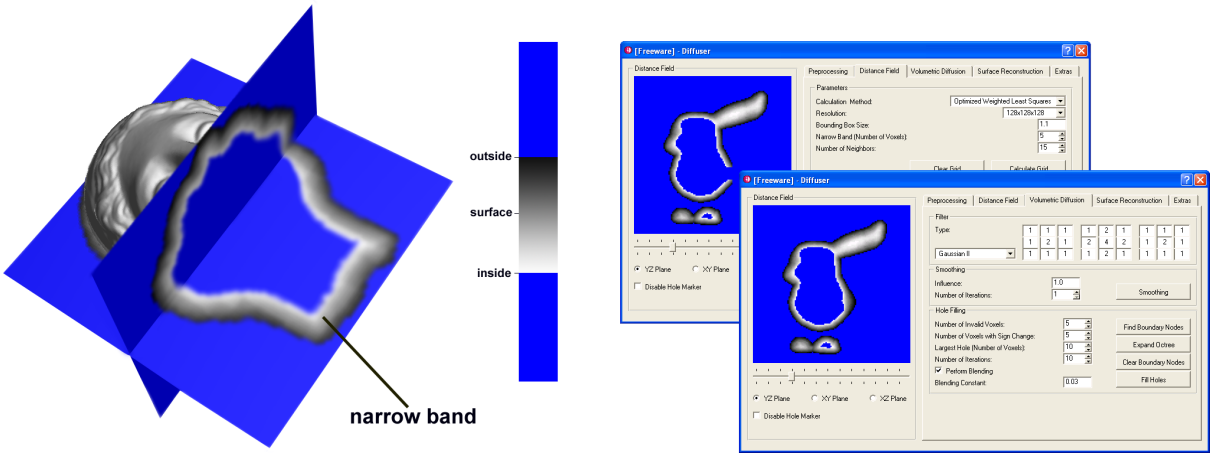

(a) (b)

Figure 3.1.: *Volumetric diffusion.* (a) *Slices of the distance volume reveal the narrow band.* (b) *The user interface of the automatic hole filling tool allows to fine-tune the algorithm. The volumetric representation can be previewed before surface reconstruction.*

(a) Caption first. *(b) Caption second.*

Figure 3.2.: *Caption of both (a), (b).*

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3.2. Second Section

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Conclusion and Outlook

TODO

Information For The Few

Nein, meine Texte les ich nicht, so nicht, st?hnte Oxmox. Er war mit Franklin, Rockwell und dem halbtaxgrauen Panther Weidemann in Memphis (Heartbreak Hotel) zugange. Sie warteten auf die fette Gill, um bei der Bank of Helvetica die Kapit?lchen in Kapital umzuwandeln. Oxmox liess nicht locker. Ich fleh euch an, rettet meine Copy, gebt meinem Body nochn Durchschuss! Kein Problem, erbarmte sich Old Face Baskerville, streichelte seinen Hund, zog seine einspaltige Poppl, legte an und traf! (Zeidank nichts Ernstes — nurn bisschen Fraktur.) Oxmox: Danke, ist jetzt mit Abstand besser. Derweil jumpte der Fox leise over the Buhl, die sich mal wieder immerdar wie jedes Jahr gesellte. Diesmal war Guaredisch ihr Erw?hlter, weil seine Laufweite einem vollgetankten Bodoni entsprach und seine ungez?gelte Unterl?nge ihre Serifen so serafisch streifte, dass sie trotz Techtelmechtelei die magere Futura, jene zuverl?ssige und gern eingesetzte Langstreckenl?uferin, rechtsb?ndig ?berholen konnten.

A.1. Foo Bar Baz

Nein, meine Texte les ich nicht, so nicht, st?hnte Oxmox. Er war mit Franklin, Rockwell und dem halbtaxgrauen Panther Weidemann in Memphis (Heartbreak Hotel) zugange. Sie warteten auf die fette Gill, um bei der Bank of Helvetica die Kapit?lchen in Kapital umzuwandeln. Oxmox liess nicht locker. Ich fleh euch an, rettet meine Copy, gebt meinem Body nochn Durchschuss! Kein Problem, erbarmte sich Old Face Baskerville, streichelte seinen Hund, zog seine einspaltige Poppl, legte an und traf! (Zeidank nichts Ernstes — nurn bisschen Fraktur.) Oxmox: Danke, ist jetzt mit Abstand besser. Derweil jumpte der Fox leise over the Buhl, die sich mal wieder immerdar wie jedes Jahr gesellte. Diesmal war Guaredisch ihr Erw?hlter, weil seine Laufweite einem vollgetankten Bodoni entsprach und seine ungez?gelte Unterl?nge ihre Serifen so serafisch streifte, dass sie trotz Techtelmechtelei die magere Futura, jene zuverl?ssige und gern eingesetzte Langstreckenl?uferin, rechtsb?ndig ?berholen konnten.

A.2. Barontes

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A.3. A Long Table with Booktabs

Table A.1.: *A sample list of words.*

ID	Word	Word Length	WD	ETL	PTL	WDplus
1	Eis	3	4	0.42	1.83	0.19
2	Mai	3	5	0.49	1.92	0.19
3	Art	3	5	0.27	1.67	0.14
4	Uhr	3	5	0.57	1.87	0.36
5	Rat	3	5	0.36	1.71	0.14
6	weit	4	6	0.21	1.65	0.25
7	eins	4	6	0.38	1.79	0.26
8	Wort	4	6	0.30	1.62	0.20
9	Wolf	4	6	0.18	1.54	0.19
10	Wald	4	6	0.31	1.63	0.19
11	Amt	3	6	0.30	1.67	0.14
12	Wahl	4	7	0.36	1.77	0.42
13	Volk	4	7	0.45	1.81	0.20
14	Ziel	4	7	0.48	1.78	0.42
15	vier	4	7	0.38	1.81	0.42
16	Kreis	5	7	0.26	1.62	0.33
17	Preis	5	7	0.28	1.51	0.33
18	Re-de	4	7	0.22	1.56	0.33
19	Saal	4	7	0.75	2.10	0.43
20	voll	4	7	0.48	1.82	0.24
21	weiss	5	7	0.21	1.59	0.36
22	?r-ger	5	7	1.16	2.69	0.59
23	bald	4	7	0.18	1.56	0.19

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Table A.1.: *(Continued)*

ID	Word	Word Length	WD	ETL	PTL	WDplus
24	hier	4	7	0.40	1.70	0.43
25	neun	4	7	0.17	1.52	0.26
26	sehr	4	7	0.36	1.85	0.43
27	Jahr	4	7	0.50	1.82	0.43
28	Gold	4	7	0.04	1.35	0.20
29	T?-ter	5	8	0.15	1.39	0.59
30	Tei-le	5	8	0.30	1.71	0.46
31	Na-tur	5	8	0.18	1.59	0.41
32	Feu-er	5	8	0.30	1.71	0.45
33	Rol-le	5	8	0.15	1.46	0.45
34	Rock	4	8	0.29	1.68	0.25
35	Spass	5	8	0.28	1.64	0.32
36	G?s-te	5	8	0.49	1.75	0.66
37	En-de	4	8	0.36	1.72	0.33
38	Kunst	5	8	0.26	1.59	0.35
39	Li-nie	5	8	0.45	1.88	0.63
40	B?u-me	5	8	0.48	1.92	0.45
41	B?h-ne	5	9	0.94	2.48	0.62
42	Bahn	4	9	0.21	1.62	0.42
43	B?r-ger	6	9	0.38	1.70	0.65
44	Druck	5	9	0.60	2.03	0.31
45	zehn	4	9	0.41	1.84	0.42
46	Va-ter	5	9	0.36	1.78	0.40
47	Angst	5	9	0.29	1.56	0.35
48	lei-der	6	9	0.13	1.47	0.52
49	h?u-fig	6	9	0.82	2.31	0.52
50	le-ben	5	9	0.38	1.85	0.40
51	aus-ser	6	9	1.20	2.26	0.57
52	be-vor	5	9	1.28	2.75	0.39
53	Kai-ser	6	9	0.92	2.37	0.53
54	Markt	5	9	0.23	1.58	0.28
55	Os-ten	5	9	0.21	1.54	0.48
56	Krieg	5	9	0.33	1.67	0.50
57	Mann	4	9	0.31	1.47	0.25
58	Hal-le	5	9	0.24	1.65	0.45
59	heu-te	5	9	0.44	1.87	0.46
60	in-nen	5	10	0.36	1.80	0.45
61	Na-men	5	10	0.28	1.72	0.41
62	jetzt	5	10	0.70	2.07	0.32
63	kei-ner	6	10	0.28	1.62	0.53
64	Schu-le	6	10	1.02	2.12	0.48

continued on next page

Table A.1.: *(Continued)*

ID	Word	Word Length	WD	ETL	PTL	WDplus
65	Ar-beit	6	10	0.34	1.70	0.52
66	An-teil	6	10	0.27	1.63	0.53
67	di-rekt	6	10	0.67	2.04	0.47
68	vor-her	6	10	0.78	2.25	0.47
69	wol-len	6	10	0.44	1.85	0.51
70	Kampf	5	10	0.70	1.96	0.27
71	?n-dern	6	10	1.18	2.62	0.65
72	lau-fen	6	10	0.21	1.64	0.52
73	Eu-ro-pa	6	10	0.23	1.53	0.66
74	statt	5	10	1.61	2.86	0.39
75	Wes-ten	6	10	0.29	1.60	0.54

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