GraphTrack: Fast and Optimal Tracking

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Problem

Special effects in movies require tracks of features through scenes. Tracks are found in an interactive process. The artist marks a position, and the computer proposes a track which is then further refined by the artist.
This is a difficult problem due to three aspects.

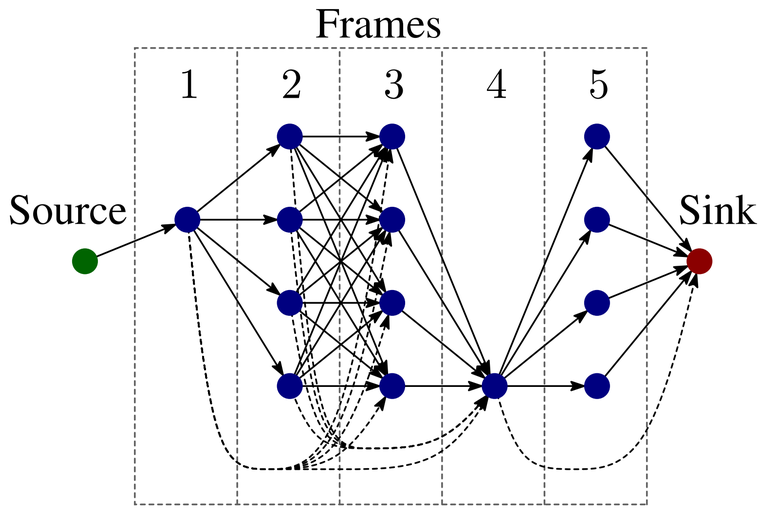
1. Sudden appearance changes due to lighting and pose
2. Occlusions
3. Speed: Interactive editing requires higher than framerate speed

Contributions

We formulated tracking as path search in a large graph, and solve it efficiently with a modificiation of Dijkstra's algorithm.
The method is based on [2]. Our main contributions are

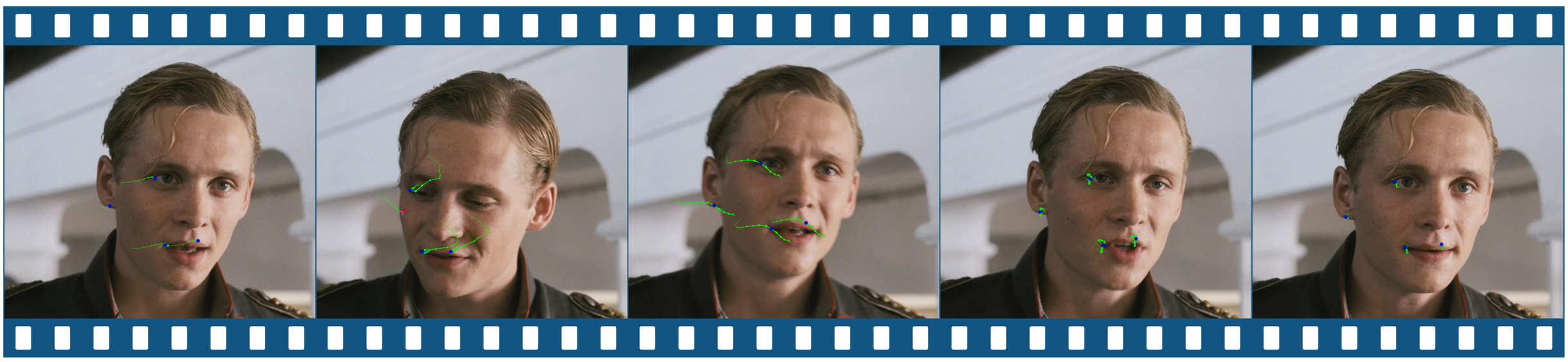
1. Efficient incorporation of a background appearance model
2. Formulation as a shortest path problem
3. Correct handling of occlusions
4. High-Efficiency implementation with up to 200 fps for a high resolution video

Method



The cost is interpreted as a directed acyclic graph with weights on the nodes and edges. The shortest path corresponds to the optimal track. The dashed edges are occlusions.

Results



Frame 0 24 48 72 95

Frame 0 100 200 300 458

Between one and three user clicks were needed to achieve accurate tracking for the head sequence. Note the correct handling of the occluded ear, which required only a single click.
The eye of the running giraffe required eight user interactions, of which three marked occlusions.

References

[1] B. Amberg, T. Vetter. GraphTrack: Fast and Globally Optimal Tracking in Videos In *CVPR '11*

[2] A. Buchanan and A. Fitzgibbon. Interactive Feature Tracking using K-D Trees and Dynamic Programming. In *CVPR '06*

A Future Direction

We incorporated a background model, where a click informs us not only that "this is how the patch looks like", but also for the rest of the frame, "this is how the patch does not look like".

Can we also *efficiently* use a background tracks model, allowing us to reason, "this would be a good track, but part of it can be better explained by another track".