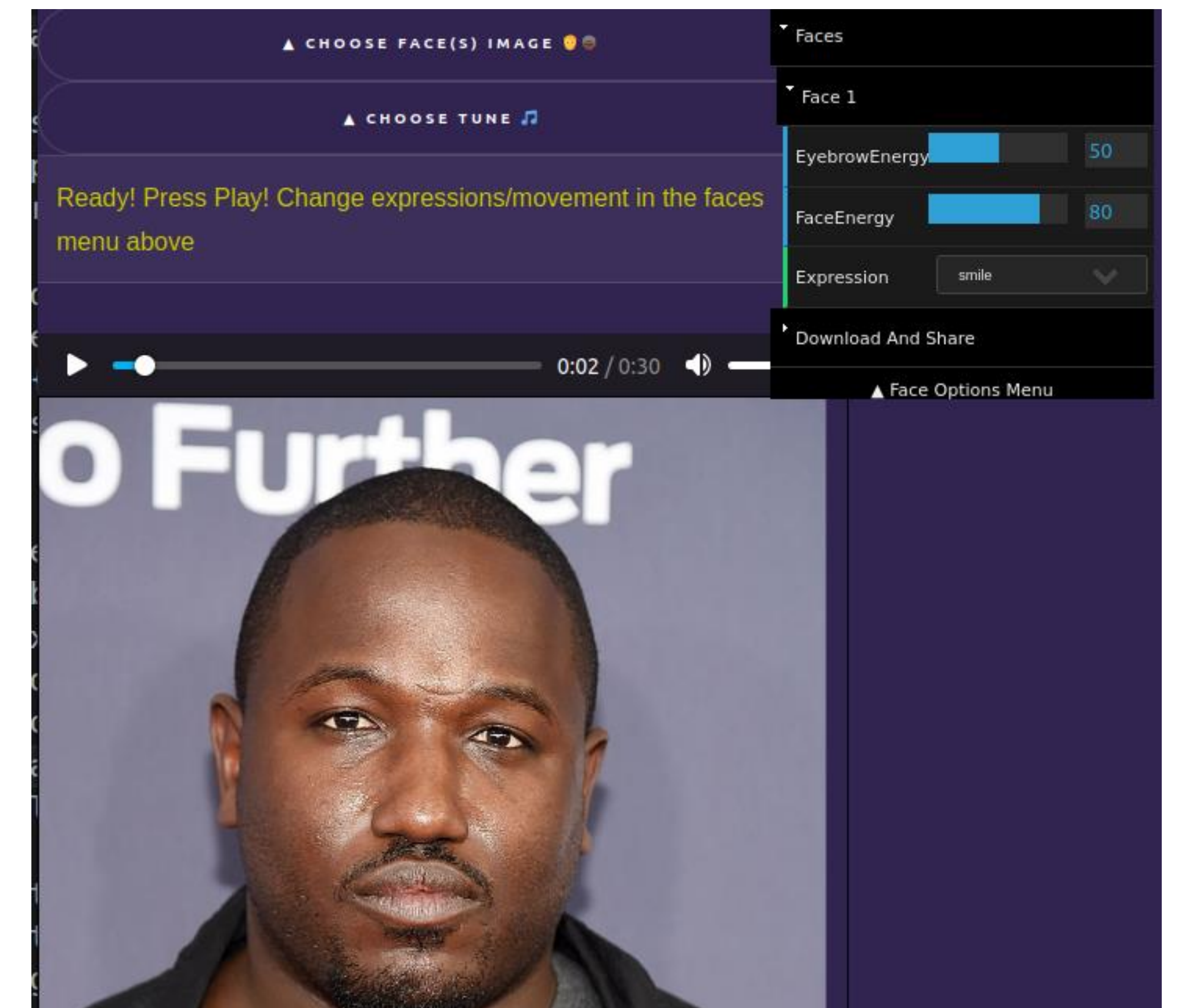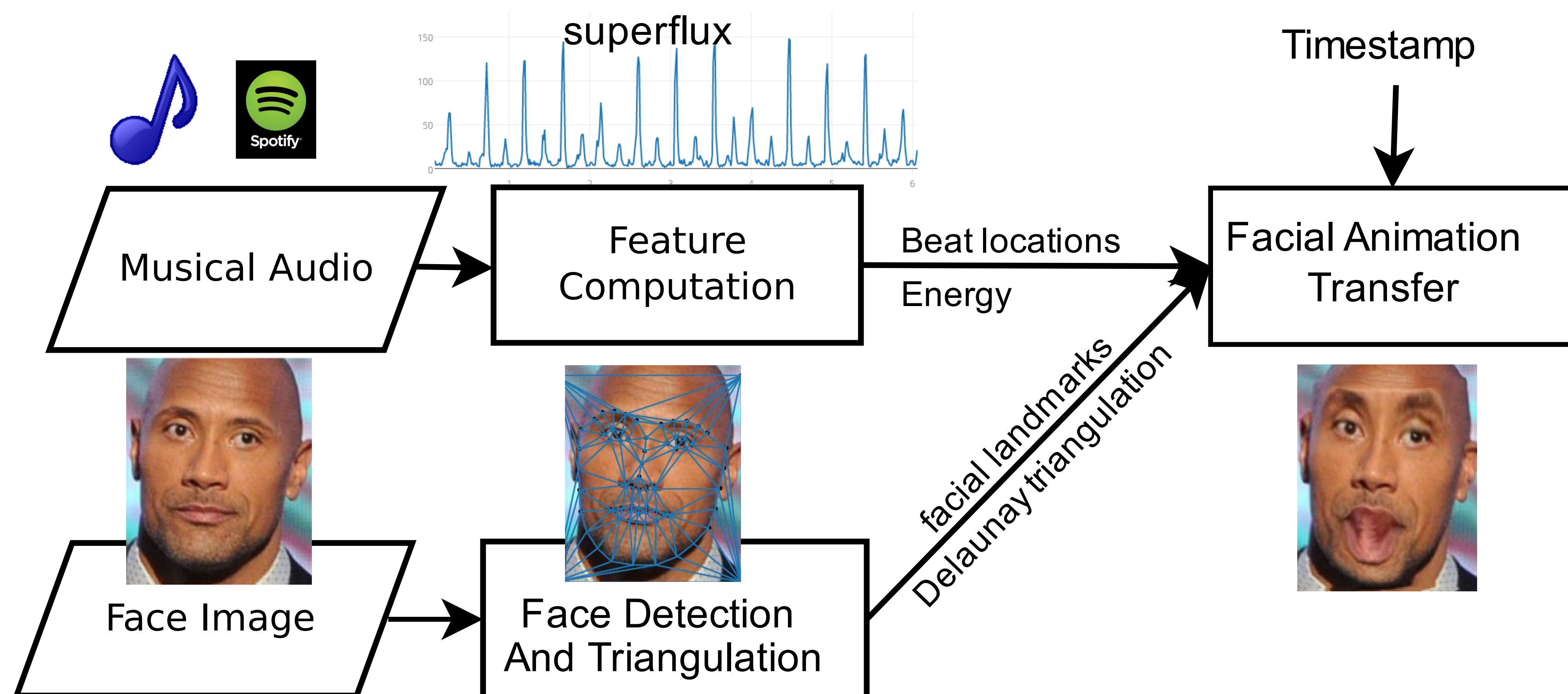# www.facejam.app: Facial Expressions for Musical Expression

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System Overview

- Extends the HAMR 2018 "best code" hack
- **Real time** app in the browser, powered via WebGL and Javascript WebAudio
- Fully client side, works on mobile
- Supports multiple faces and real time beat tracking
- Can load 30 second clips from Apple Music, record audio, or use many music meme templates (e.g. Numa Numa, Rick Roll, Chocolate Rain, etc)
- Beats mapped to eyebrows, instantaneous energy mapped to facial expressions

System Details

- We use Delaunay triangulations to extend maps from facial landmarks to a piecewise affine warp of all pixels
- Warps from the model are transferred to the target via barycentric coordinates

Model Face   Target Face   Target Face Warped
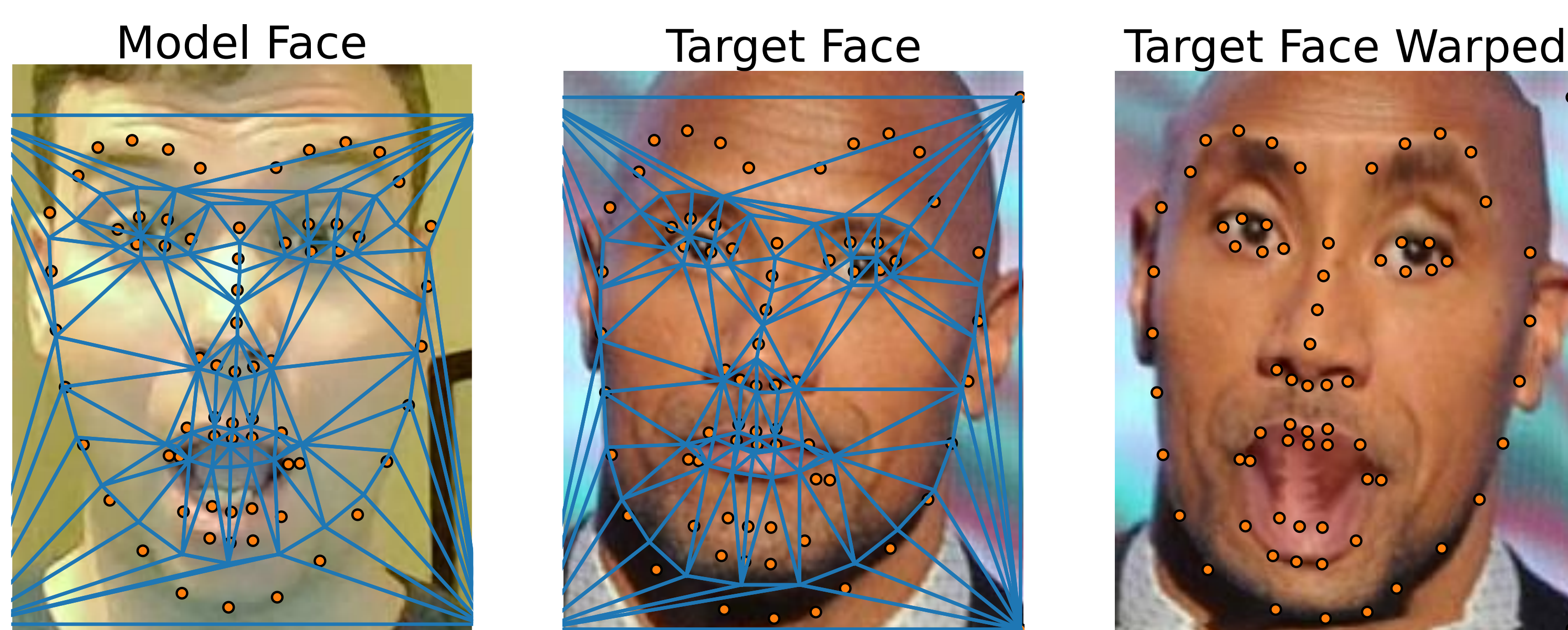
- We build a triangulation over multiple faces by performing a constrained Delaunay triangulation on the bounding boxes of each face and then putting the original triangulation within each face. Each face moves within its bounding box

Original Bounding Box   Constrained Delaunay Triangulation   Full Triangulation
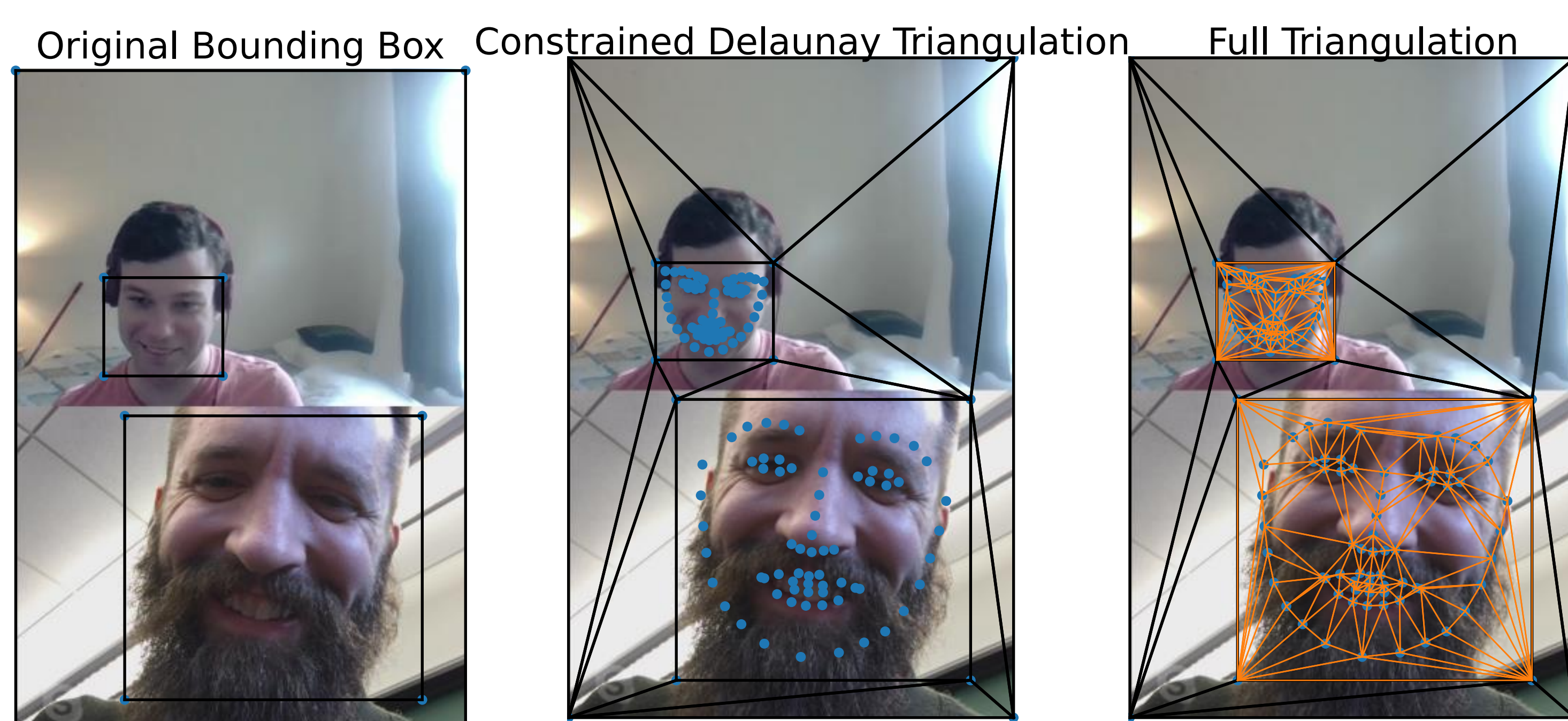
- We do offline beat tracking using the technique of Ellis[1]
- We also do online beat tracking via a streaming microphone using a Bayes filter over the efficient joint beat phase/tempo state space proposed by Krebs[2, 3]. For simplicity, we use superflux audio novelty[4] as our observation function
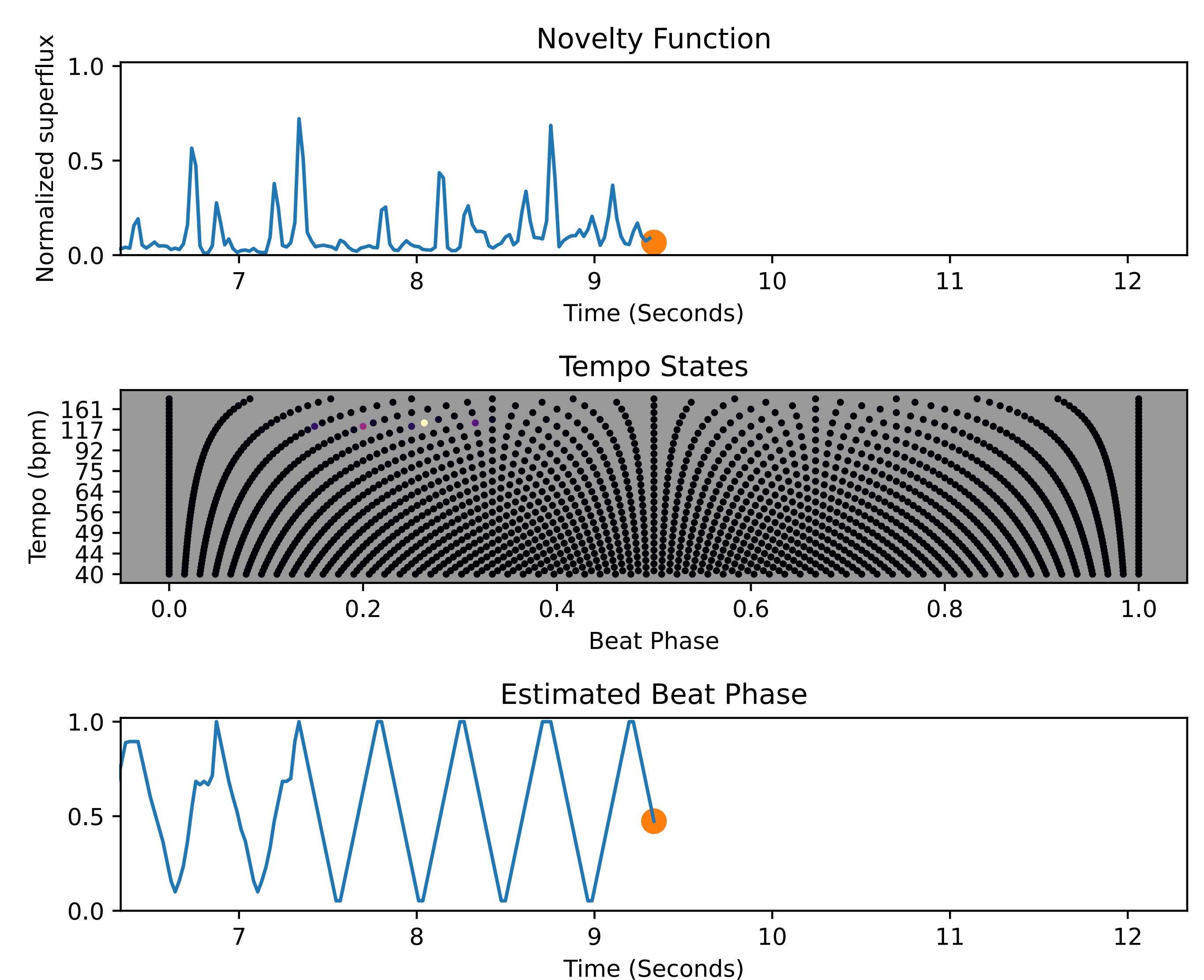
[1] D. P. Ellis, "Beat tracking by dynamic programming," Journal of New Music Research, vol. 36, no. 1, pp. 51– 60, 2007

[2] F. Krebs, S. Böck, and G. Widmer, "An efficient statespace model for joint tempo and meter tracking." in Proc. of the 16th Int. Conf. on Music Information Retrieval (ISMIR). Malaga, Spain, 2015, pp. 72–78.

[3] M. Heydari and Z. Duan, "Don't look back: An online beat tracking method using rnn and enhanced particle filtering," in ICASSP 2021-2021 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP). IEEE, 2021, pp. 236–240.

[4]] S. Böck and G. Widmer, "Maximum filter vibrato suppression for onset detection," in Proc. of the 16th Int. Conf. on Digital Audio Effects (DAFx). Maynooth, Ireland, vol. 7, 2013.