Active Learning of Intuitive Sound Qualities

Anna Huang, David Duvenaud, Kenneth Arnold, Brenton Partridge, Josiah Oberholtzer
Harvard University, University of Cambridge
Synthesizers: rich, low-level controls but a daunting instrument to play!
Problem: Unintuitive controls

• Want to adjust high-level qualities of a sound
• E.g.: Want to make this sound more ‘spooky’
• Challenge: The mapping from synthesizer controls to amount of a quality is usually complex
Solution: High-level Knobs

We’ll attempt to make a dial which directly adjusts a single quality of a sound. “Turn up the scary knob!”

- First, learn mapping from synth controls to sound quality levels
- Given the mapping, we can automatically adjust a quality of a sound by moving synth controls in the direction that changes that quality.
- knob moves us along a path in control space
Solution: High-level Knobs

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- First, learn mapping from synth controls to sound quality levels
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- Knob/slider moves us along a path in control space
Active Learning of the Mapping: Querying the User

- Motivation: Hard for users to find training examples
- Use active learning to query the user at point that most informative to improving performance of tool
  - Utility: model’s confidence in adjusting sounds to have desired levels of that quality
- Loops over:
  1. **Fit the model**: compute posterior over quality mapping given current observations
  2. **Propose set of points** we might want to query the user
  3. For each proposed point, evaluate the **expected utility** of tool performance if queried at that point
  4. **Query user** at best point
  5. **User rate** the point
Step 1: Compute posterior over quality mapping given current observations

Gaussian Process prior on function from synth control to high-level quality (i.e. scary)
How good is the current model?
Expected Utility: confidence on path attaining desired qualities

Mapping from controller to quality

Prob of attaining quality

Perceived scariness

Desired scariness
STEP 2. Propose set of points we might want to query the user

Perceived scariness

Desired scariness

Mapping from controller to quality

Prob of attaining quality

true function
posterior mean
observations
starting point
proposed points

perceived level of high-level quality

level of high-level quality

synthesizer controller

+-\epsilon probability mass
STEP 3.1: For each proposed point, fantasize outcome

Perceived scariness

Desired scariness

Mapping from controller to quality

Prob of attaining quality

Perceived level of high-level quality

Desired level of high-level quality

Synthesizer controller
STEP 3.2: Re-optimize hyperparameters, evaluate expected utility of point

Lightning CMS
Discussion

• General formulation to support users define richer personal controls over machine provided controls
  – Can be used for basically anything like adjusting animations, images, fonts, whenever generated parametrically

• Preliminary results on synthesizers

• Demo time!
  – If nothing crashes, we’ll show how we learn a simple high-level knob from scratch, with human’s in the loop
Screenshot of interface