MounTune: Musifying Mountain Photography

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Introduction to Computational and Biological Vision

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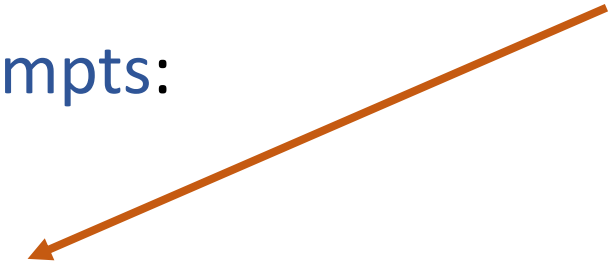
Motivation

- Ra’aya is a mountain lover who travels around the world.
- She likes to take photos of the mountain landscapes she comes across.
- Once in her travels she thought to herself:
- “How would these mountains sound like as music?”
- Our journey begins here.

Generate Y from X

- Visual arts from text prompts:
  - DALL-E 2
  - Midjourney
- Texts of different kinds from text prompts:
  - GPT-4
- Poetry from photos:
  - word.camera
- Music from text prompts:
  - MusicLM
- Music from photos:
  - **MounTune**



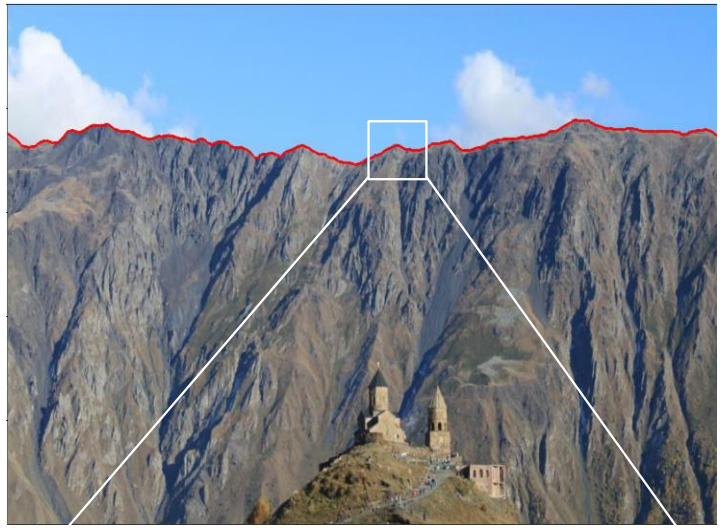
We are here!

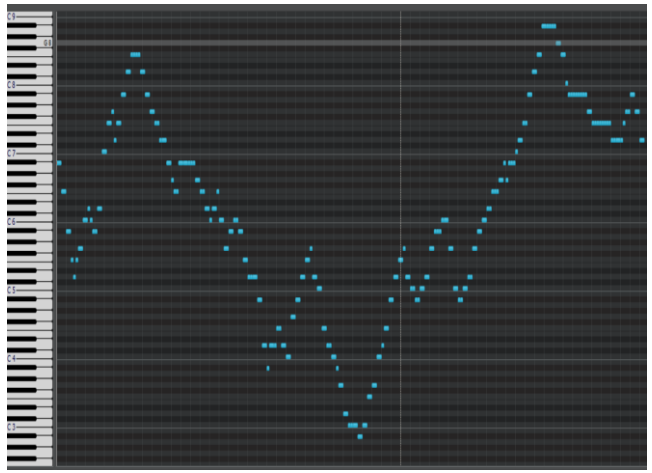
Goal

- Leveraging an existing data source to enhance musicians' composition capabilities.
- Our data source:
  - Mountain summits' y-positions in the photo over the x-axis (left-to-right).

From Photos

GOAL OF THE PROJECT

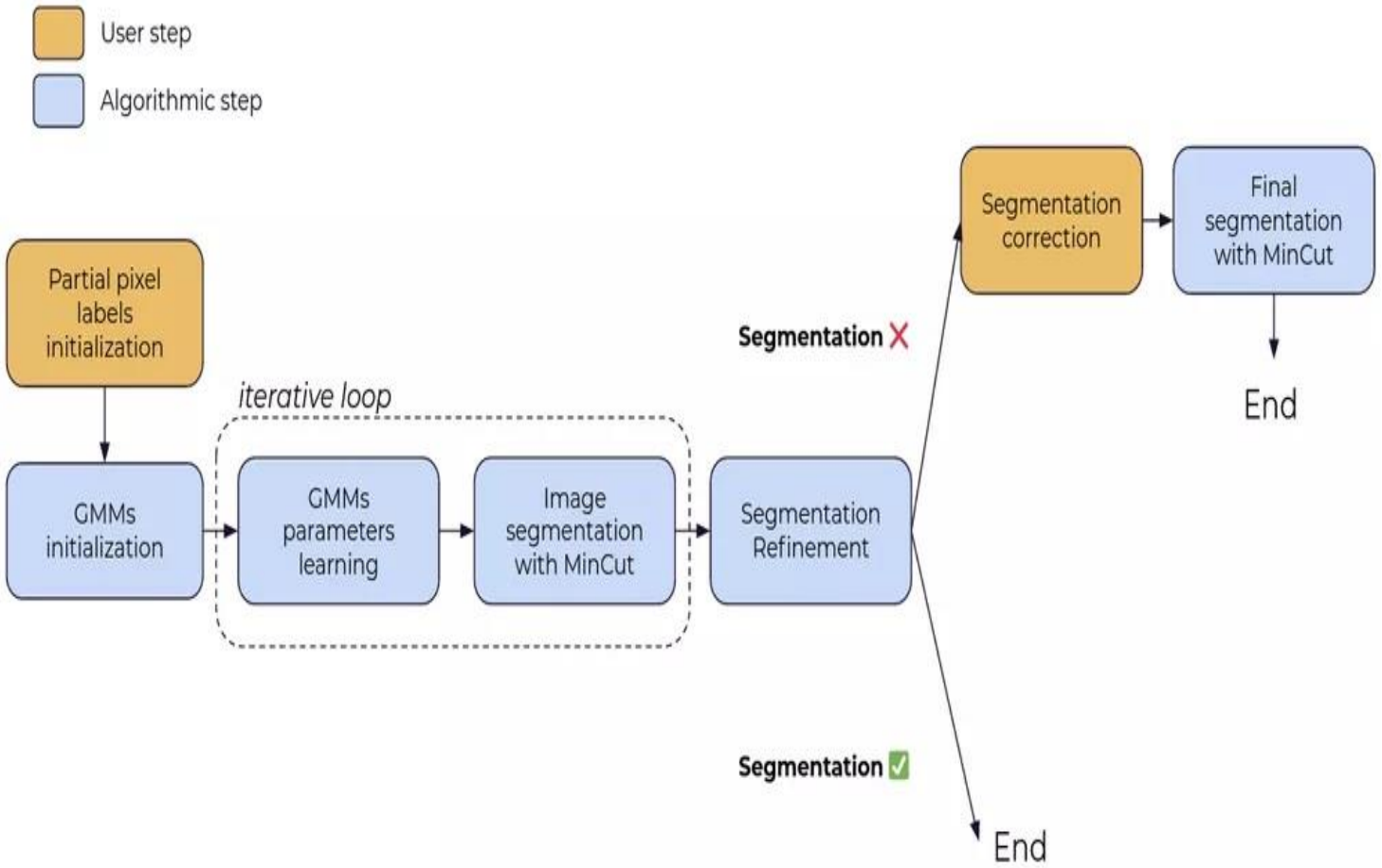


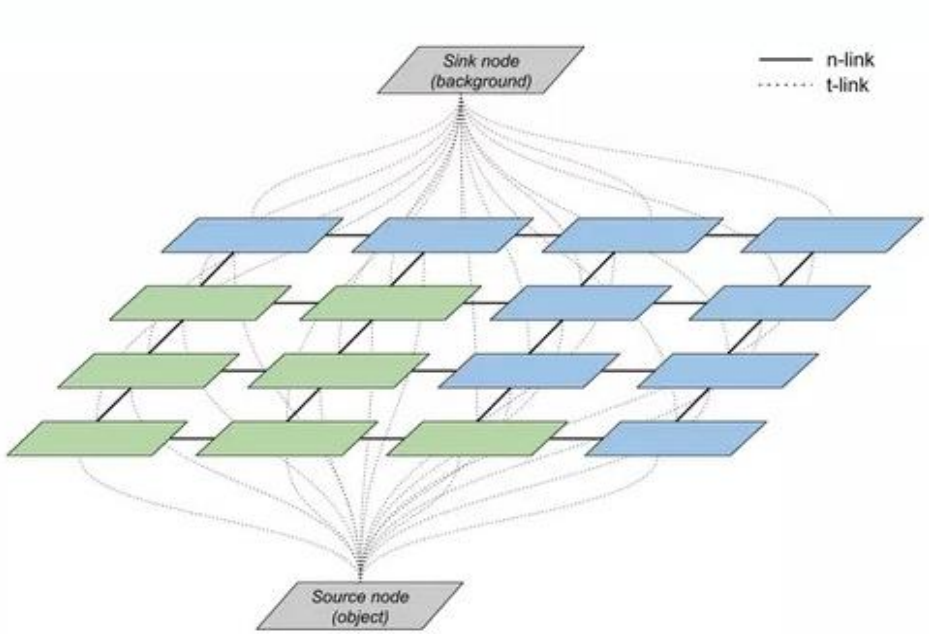


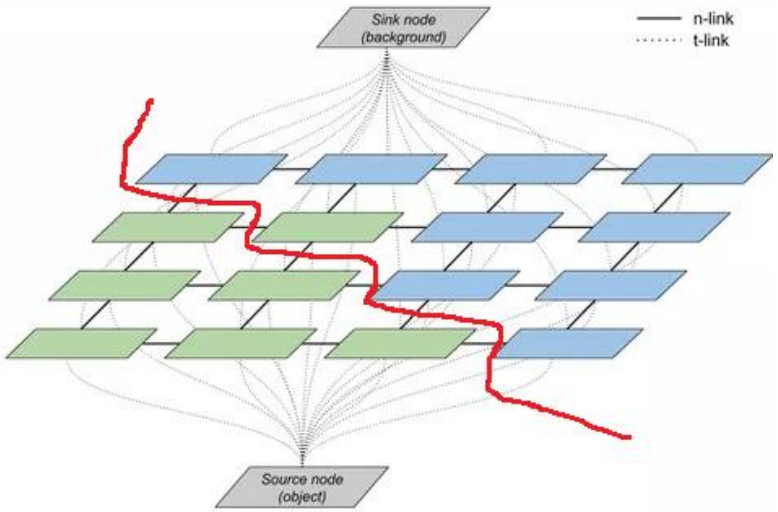
APPROACH AND METHOD

“SMOOTHED-SHARPENING”

FOREGROUND MASK EXTRACTION USING GRABCUT



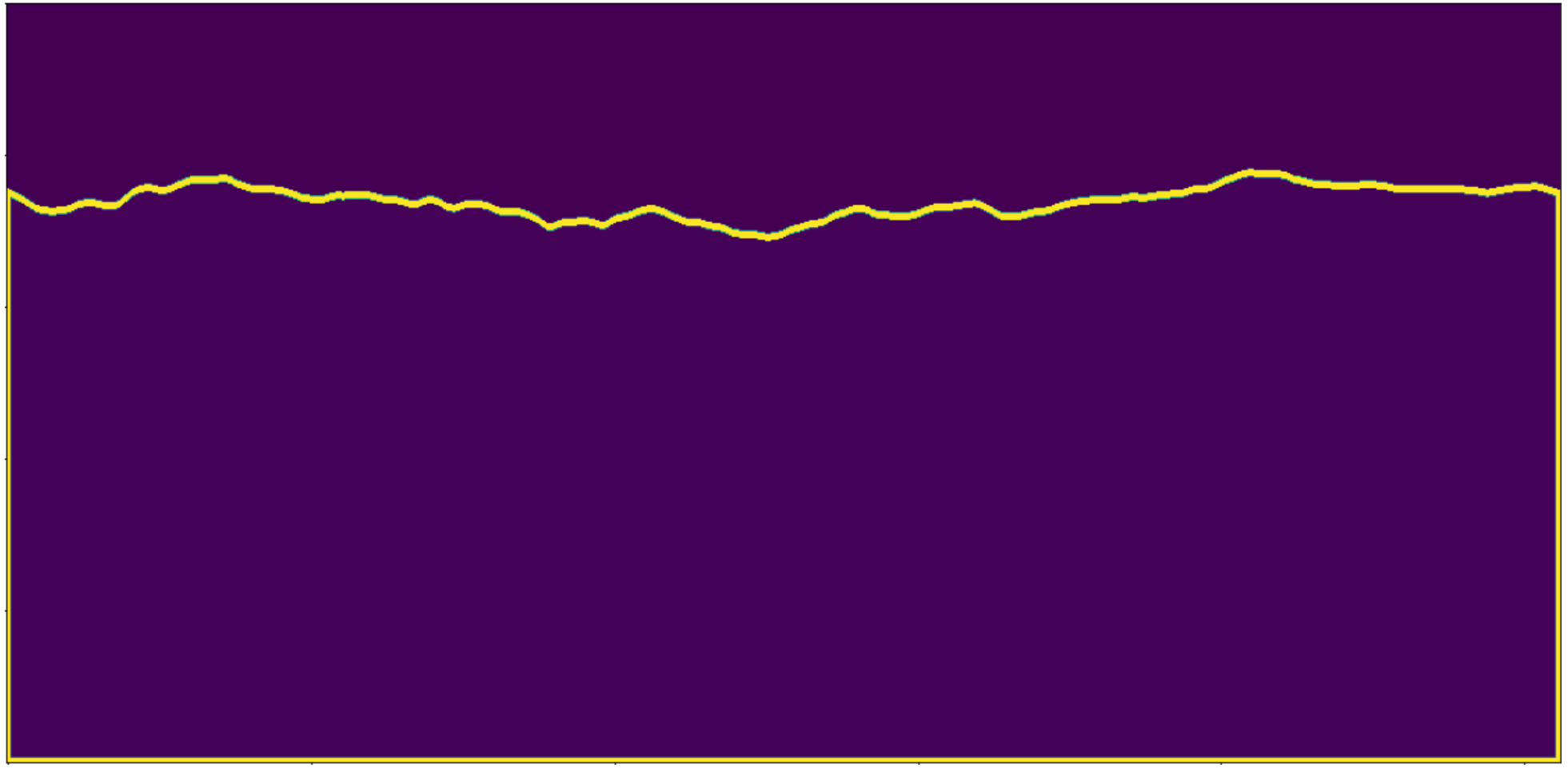




FOREGROUND MASK EXTRACTION USING GRABCUT

SMOOTHING THE MASK

CONTOUR APPROXIMATION



FILTERING REDUNDANT CONTOUR POINTS

CONTOUR READY FOR MUSIFICATION

MORE EXAMPLES

MORE EXAMPLES

MORE EXAMPLES

FIXING BAD RESULT WITH USER INPUT

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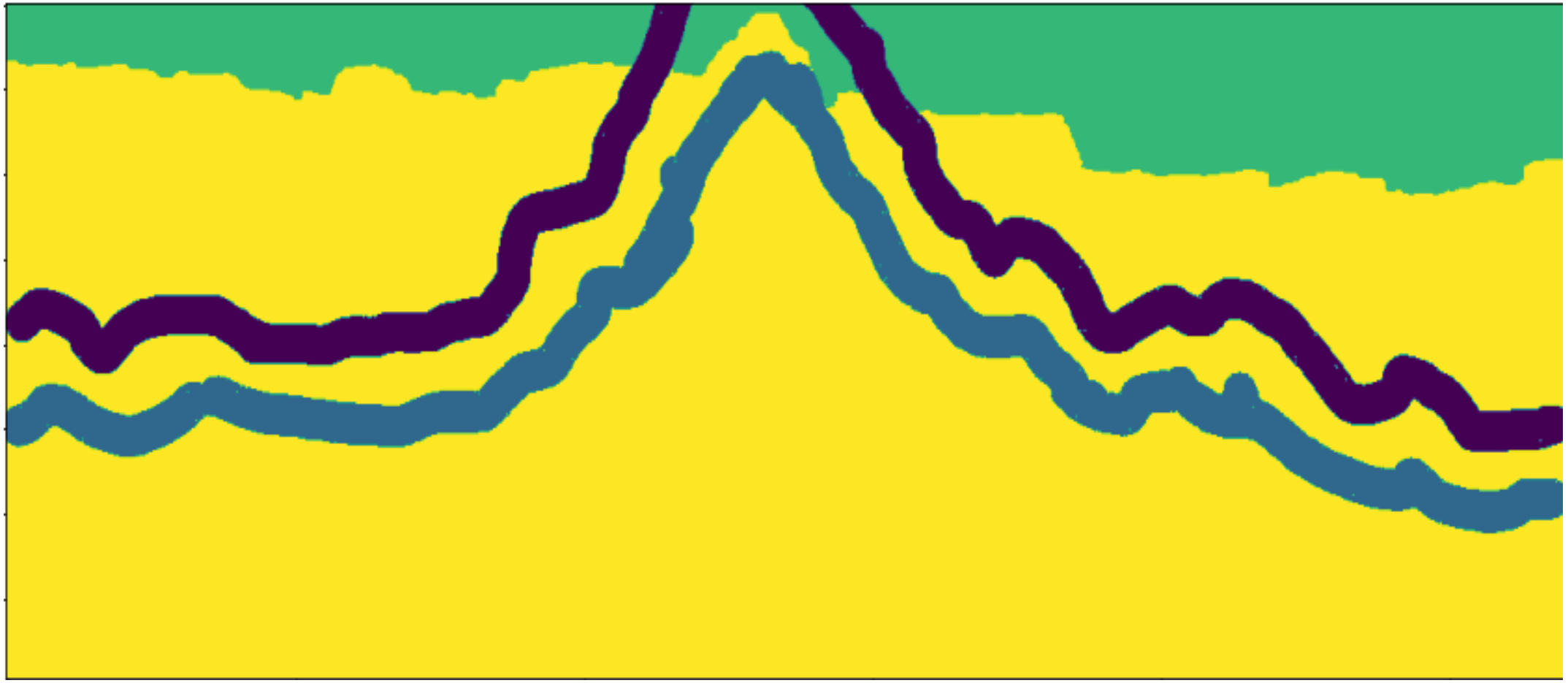

FIXING BAD RESULT WITH USER INPUT

To Music

Prior: Explain (Western) Music Theory Like I'm 5

- An **octave** consists of 12 **semitones**.
- The **pitch** difference between two consecutive semitones is equal on a logarithmic scale.
- Each semitone sounds "the same" shifted up or down by an octave.
- Every musical instrument has a **range** (all pitches it can play).
- A **musical note** represents one of the 12 semitones:
  - A, A#, B, C, C#, D, D#, E, F, F#, G, G#
- A **musical scale** consists of a subset of the 12 semitones, with one of those being the starting note. Examples:
  - C major: **C**, D, E, F, G, A, B
  - F# minor **penta**tonic: **F#**, A, B, C#, E

Prior: MIDI

- Standard for representing time series of musical note events in digital format.
- Time steps are according to tempo (beats per minute).
- Notes are represented by a number.
- Widely used skeleton in music production.

	Note Numbers											
Octave	C	C#	D	D#	E	F	F#	G	G#	A	A#	B
0	0	1	2	3	4	5	6	7	8	9	10	11
1	12	13	14	15	16	17	18	19	20	21	22	23
2	24	25	26	27	28	29	30	31	32	33	34	35
3	36	37	38	39	40	41	42	43	44	45	46	47
4	48	49	50	51	52	53	54	55	56	57	58	59
5	60	61	62	63	64	65	66	67	68	69	70	71
6	72	73	74	75	76	77	78	79	80	81	82	83
7	84	85	86	87	88	89	90	91	92	93	94	95
8	96	97	98	99	100	101	102	103	104	105	106	107
9	108	109	110	111	112	113	114	115	116	117	118	119
10	120	121	122	123	124	125	126	127				

Turning Integer Sequences to MIDI File

- Choose some scale from a list and a starting note.
- Create a list of relevant notes according to scale are saved, ordered from lowest pitch to highest.
- Convert summit points to list of relative heights with minimal value 0 ordered by x value.
  - Lower height = lower value
- Create note durations using convolution with 1D Sobel filter with minimal threshold 0.
  - Higher (absolute) delta = longer duration
- Iteratively compress note durations until maximal note duration doesn’t exceed some value.
- Add 1 to all note durations.
  - Prototype design choice: enforce no moments of silence.

Turning Integer Sequences to MIDI File (Cont.)

- Iteratively compress summit heights until maximal height doesn't exceed the index of last item in the list of relevant notes.
  - We'll reference the summit heights as "notes as integers" from now on.
- Average notes as integers and durations over windows of some size.
  - Example:
    - Window size = 4
    - Notes as integers = [..., 33, 33, 34, 36, ...] => [..., 34, ...]
    - Durations = [..., 1, 1, 2, 3, ...] => [..., 2, ...]
  - Lowers the probability of consecutive note duplicates or one-step moves.
- Optionally, remove sequential duplicate notes by averaging their durations.
- Convert notes as integers to (note, octave) tuples using the list of relevant notes (each integer is an index of a note in the list).
- Convert the tuples to MIDI numbers.
- Write to MIDI file using the MIDI numbers and durations.

Results

D# Ukrainian Dorian
No sequential duplicates
MIDI skeleton

E Major Pentatonic
Inc. sequential duplicates
Inc. manual sound design

Summary

- Inspired by Ra’aya’s idea we created something really cool.
- Take photos of mountain landscapes.
- Turn them into MIDI files using MounTune.
- Use the MIDI files for music production.
- Enjoy.
- Fund us to make it more of a real product rather than a prototype.