CV Studio

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Use Case: Sound Generation

- A way for users to create music using gesture commands
  - Stomp feet, clap hands, wave arms, etc.

- Supplemented with a glove that contains buttons for more combinations of sounds
  - Press a button to create different sound with same gesture

Use Case: Studio Capabilities

- Be able to edit a small loop of music
  - Align notes to the beat
  - Remove unwanted notes
  - Delete previously recorded clips
  - Move notes around
- Be able to build on top of saved work

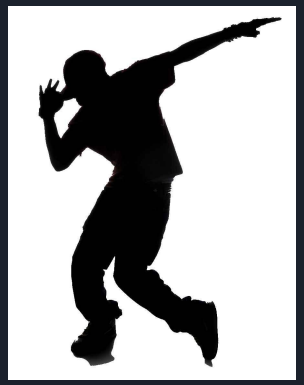
Scope

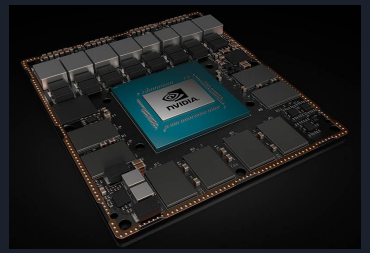
- Software and signals areas
- Create a simple but pleasurable user experience for translation of movement in music
- Most sophistication will be in our gesture recognition algorithm
    - Be able to recognize a couple of gestures with high accuracy and low latency
    - Wrap this in software that has studio capabilities (Ableton Live)

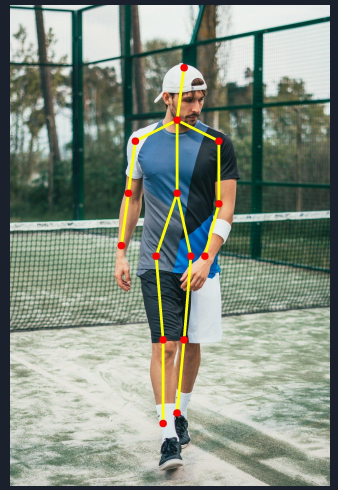
Requirements

- Low latency recognition - less than hindrance auditory delay for performers - 80 ms
- Accuracy of recognizing actions - 90%
  - Accuracy in papers ranged from 85-95%, with the mean being slightly above 90%
- 8 gestures per second - at 120 bpm (average bpm of all music), this is 4 actions per beat, which allows us to make complex music
- Must function correctly in at least 0.5 to 2 m from camera range
- Minimum number of recognizable actions - 5

Solution Approach







Hardware Options

Plan A: NVIDIA Xavier (potentially borrowed from Prof Savvides)

Plan B: NVIDIA Jetson TK1 (~$200): could lack GPU power to perform our calculations and put latency in jeopardy

Plan C: Use our personal machines*

*Preferable to develop a standalone system without relying on our personal equipment

Minimum Viable Product

- Basic functionality of making music with actions
  - Working algorithm, everything integrated
- No studio functionality
  - Just be able to play sounds
- Requirements met
  - Latency: 80ms
  - Gestures: 5
  - Accuracy: 90%

Testing, Verification, and Metrics

Metric	Requirement	Testing Method
Latency	< 80 ms	High frame rate camera timing analysis
Accuracy	> 90%	User testing under controlled conditions with > 100 trials per gesture
Distance from camera	0.5 - 2 m	User testing at set of distances x = {0.3, 0.4, 0.5, …, 2.5}
Ease of Use	Qualitative (75% approval)	User testing with survey questions

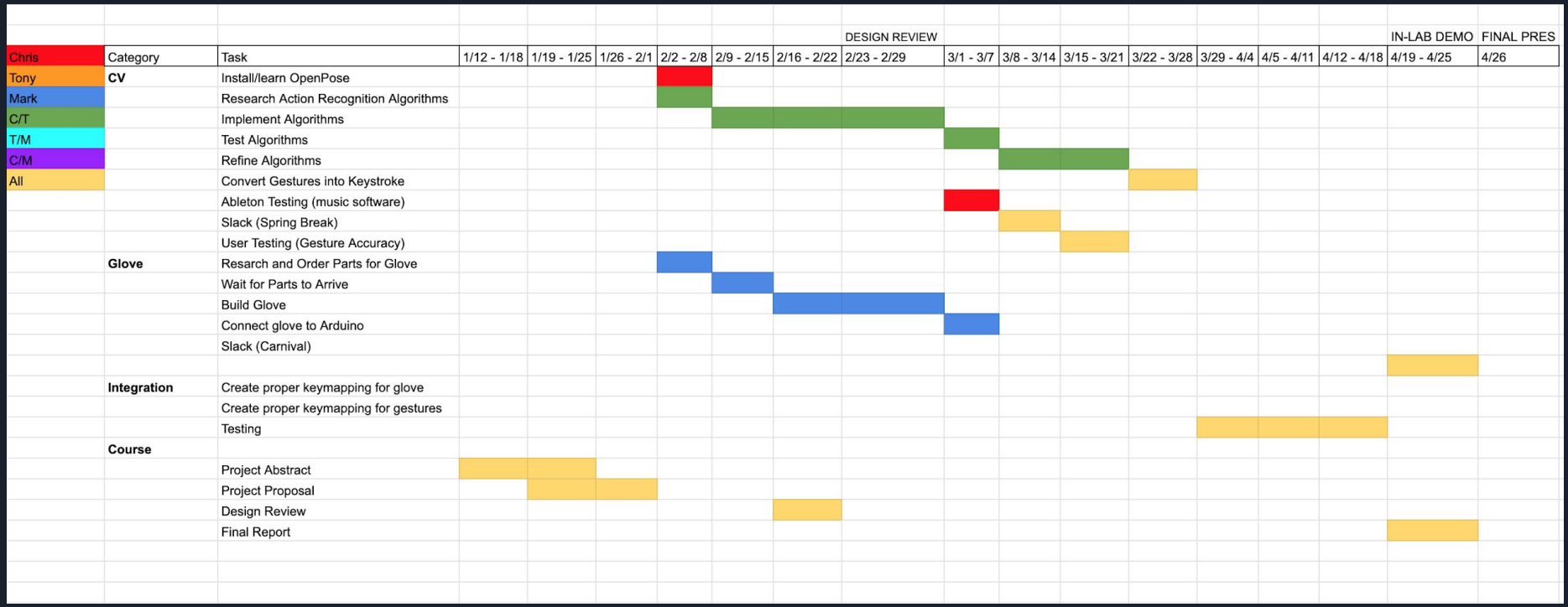
Challenges

- Ability to lower latency enough so that one could play music comfortably
  - Xavier should provide enough computational power but other devices will likely fall short
- Correct classification of small movements (e.g. fast claps)

Tasks and Division of Labor

- Chris - software focus - develop wrapper around commands to generate a cohesive interface
- Tony - algorithm focus - experiment with algorithms and find the best ones
- Mark- hardware focus - design and construct glove component and ensure that devices can communicate with each other

Schedule



									DESIGN REVIEW								IN-LAB DEMO	FINAL PRES
Chris	Category	Task	1/12 - 1/18	1/19 - 1/25	1/26 - 2/1	2/2 - 2/8	2/9 - 2/15	2/16 - 2/22	2/23 - 2/29	3/1 - 3/7	3/8 - 3/14	3/15 - 3/21	3/22 - 3/28	3/29 - 4/4	4/5 - 4/11	4/12 - 4/18	4/19 - 4/25	4/26
Tony	**CV**	Install/learn OpenPose																
Mark		Research Action Recognition Algorithms																
C/T		Implement Algorithms																
T/M		Test Algorithms																
C/M		Refine Algorithms																
All		Convert Gestures into Keystroke																
		Ableton Testing (music software)																
		Slack (Spring Break)																
		User Testing (Gesture Accuracy)																
	Glove	Resarch and Order Parts for Glove																
		Wait for Parts to Arrive																
		Build Glove																
		Connect glove to Arduino																
		Slack (Carnival)																
	Integration	Create proper keymapping for glove																
		Create proper keymapping for gestures																
		Testing																
	Course																	
		Project Abstract																
		Project Proposal																
		Design Review																
		Final Report																