References for 16-848 for February 12, 2020

I began by talking about Russian scientist Nikolai Bernstein
https://en.wikipedia.org/wiki/Nikolai_Bernstein

If you find his ideas interesting, you may want to have a look at this book:

Bernstein, N., M. Latash, and M. Turvey. "Dexterity and its development (resources for ecological psychology)." (1998).
https://www.amazon.com/s?k=nikolai+bernstein&ref=nb_sb_noss_2

I then mentioned the overview produced by the European project "The Hand Embodied."   I found this survey to be very informative.

Santello, Marco, Matteo Bianchi, Marco Gabiccini, Emiliano Ricciardi, Gionata Salvietti, Domenico Prattichizzo, Marc Ernst et al. "Hand synergies: integration of robotics and neuroscience for understanding the control of biological and artificial hands." Physics of life reviews 17 (2016): 1-23.
https://www.sciencedirect.com/science/article/abs/pii/S1571064516000269

We then discussed three papers.

The first attempts to use fMRI to determine whether the brain encodes synergies in the way we think about synergies.

Leo, Andrea, Giacomo Handjaras, Matteo Bianchi, Hamal Marino, Marco Gabiccini, Andrea Guidi, Enzo Pasquale Scilingo et al. "A synergy-based hand control is encoded in human motor cortical areas." Elife 5 (2016): e13420.
https://elifesciences.org/articles/13420

The second paper described EMG control of a prosthetic hand (an ILimb hand) using 10 EMG signals, which is far more than the usual prosthetic device.   One of the techniques used to make this possible was to focus on four functional grasps: a precision grasp, a power grasp, pointing with the index finger, and grasping a credit card using a lateral grasp.

Gijsberts, Arjan, Rashida Bohra, David Sierra González, Alexander Werner, Markus Nowak, Barbara Caputo, Maximo Alejandro Roa, and Claudio Castellini. "Stable myoelectric control of a hand prosthesis using non-linear incremental learning." Frontiers in neurorobotics 8 (2014): 8.
https://www.frontiersin.org/articles/10.3389/fnbot.2014.00008/full?utm_source=twitterfeed&utm_medium=twitter

The third paper described using Jacobian transpose control to control the Schunk 9DoF hand in a 3DoF synergy space.

Ficuciello, Fanny. "Synergy-based control of underactuated anthropomorphic hands." IEEE Transactions on Industrial Informatics 15, no. 2 (2018): 1144-1152. https://ieeexplore.ieee.org/abstract/document/8367781

The same author has also explored reinforcement learning in synergy space.   The paper is here:

Ficuciello, Fanny, Damiano Zaccara, and Bruno Siciliano. "Synergy-based policy improvement with path integrals for anthropomorphic hands." In 2016 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 1940-1945. IEEE, 2016.   https://ieeexplore.ieee.org/abstract/document/7759306 https://www.youtube.com/watch?v=tO8yKwcm1js

While searching, I also found that she had published this recent interesting survey:

Ficuciello, Fanny, Pietro Falco, and Sylvain Calinon. "A brief survey on the role of dimensionality reduction in manipulation learning and control." IEEE Robotics and Automation Letters 3, no. 3 (2018): 2608-2615. https://ieeexplore.ieee.org/abstract/document/8323188