References for 16-848 for February 9, 2022

We started by talking about human benchmark tests, including these:

The Kapandji test:
https://en.wikipedia.org/wiki/Kapandji_score
https://ars.els-cdn.com/content/image/1-s2.0-S0266768103000160-gr6.jpg

Block and Box test:
https://www.youtube.com/watch?v=jmpNXj5oOo0

Purdue Pegboard test (fine dexterity):
https://www.youtube.com/watch?v=xXT9E4OY9tw

ARAT test (different shaped objects):
https://www.youtube.com/watch?v=f8oiH5OA1Cw

Jebsen Hand Function test (daily living):
https://www.youtube.com/watch?v=ZUzS0ORtz6M
https://www.sralab.org/rehabilitation-measures/jebsen-hand-function-test

Sollerman test (daily living, including bimanual actions):
https://www.youtube.com/watch?v=adaoXVzp3ks
http://www.swisswuff.ch/images/adl/adl-pdf/sollermann1995handfunctiontest.pdf

SHAP test (a more recent test):
https://www.youtube.com/watch?v=5Lby_R0EDeQ

The subject in this video is using Otto Bock's Michelangelo Prosthetic Hand, which you can read about here:
https://www.ottobockus.com/prosthetics/upper-limb-prosthetics/solution-overview/michelangelo-prosthetic-hand/

In robotics, benchmarks often take the form of competitions, such as the DARPA ARM challenge:
https://www.youtube.com/watch?v=jeABMoYJGEU

The National Institute of Standards and Technology is making a strong effort to establish a variety of benchmarks for evaluating robot hands, and their current benchmark set can be found here:
https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1227-draft.pdf
This paper introduces the YCB object dataset, designed to at least standardize the object set that we use for benchmarking. I have one of these sets in my office.
http://www.ycbbenchmarks.com/object-set/

The benchmarks that we browsed, posted to the YCB website are here:
http://www.ycbbenchmarks.com/protocols-and-benchmarks/

Here are a few more interesting references:

Cruciani, Silvia et al. “Benchmarking In-Hand Manipulation.” IEEE Robotics and Automation Letters 5.2 (2020): 588–595.
https://arxiv.org/abs/2001.03070

Cruciani, Silvia, Christian Smith, Danica Kragic, and Kaiyu Hang. "Dexterous manipulation graphs." In 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 2040-2047. IEEE, 2018.
https://ieeexplore.ieee.org/abstract/document/8594303/

Llop-Harillo, Immaculada, Antonio Pérez-González, Julia Starke, and Tamim Asfour. "The Anthropomorphic Hand Assessment Protocol (AHAP)." Robotics and Autonomous Systems 121 (2019) https://www.sciencedirect.com/science/article/pii/S0921889019300946

Yang, Boling, Patrick Lancaster, Siddhartha Srinivasa, and Joshua R. Smith. "Benchmarking Robot Manipulation with the Rubik's Cube." IEEE Robotics and Automation Letters (2020).
https://ieeexplore.ieee.org/abstract/document/8972349/

This paper discusses the "reachable configuration manifold." Especially see Figure 13
https://journals.sagepub.com/doi/pdf/10.1177/0278364914558494

These videos https://youtu.be/5V6FLd7KvNk https://youtu.be/6ry0j2YUQBc are from different papers, but still helpful in understanding what's going on.

There's also this paper https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8793727 (Morgan, Bircher, Calli, Dollar, 2019) which discusses several different dexterity metrics in Section III A.