

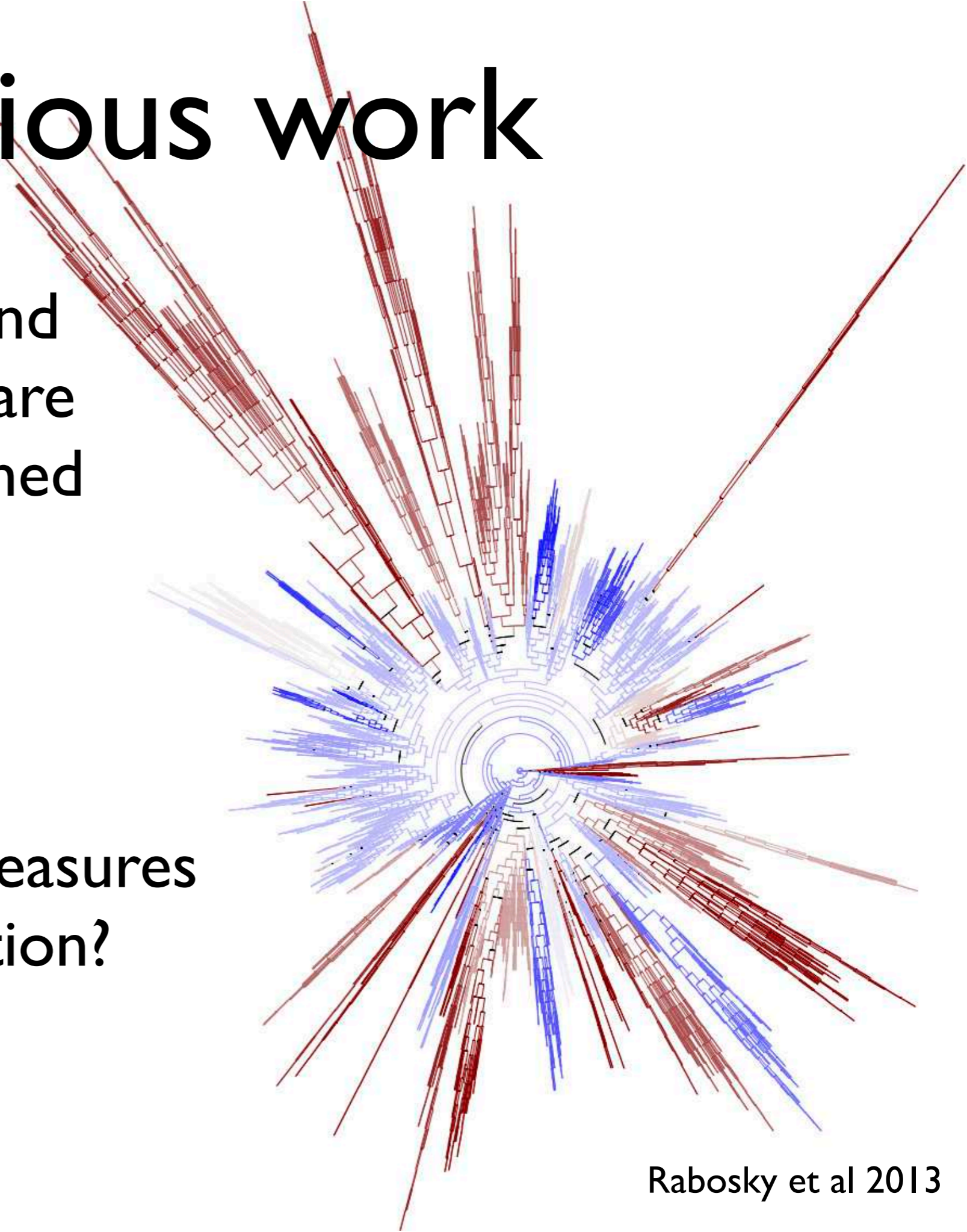
Morphology and exploitation in ray-finned fishes using crowdsourced data

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Dan Rabosky
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Evolution
June 22, 2013
Snowbird, Utah

previous work

- rates of speciation and body size evolution are correlated in ray-finned fishes
- evolvability drives speciation
- what about other measures of phenotypic evolution?





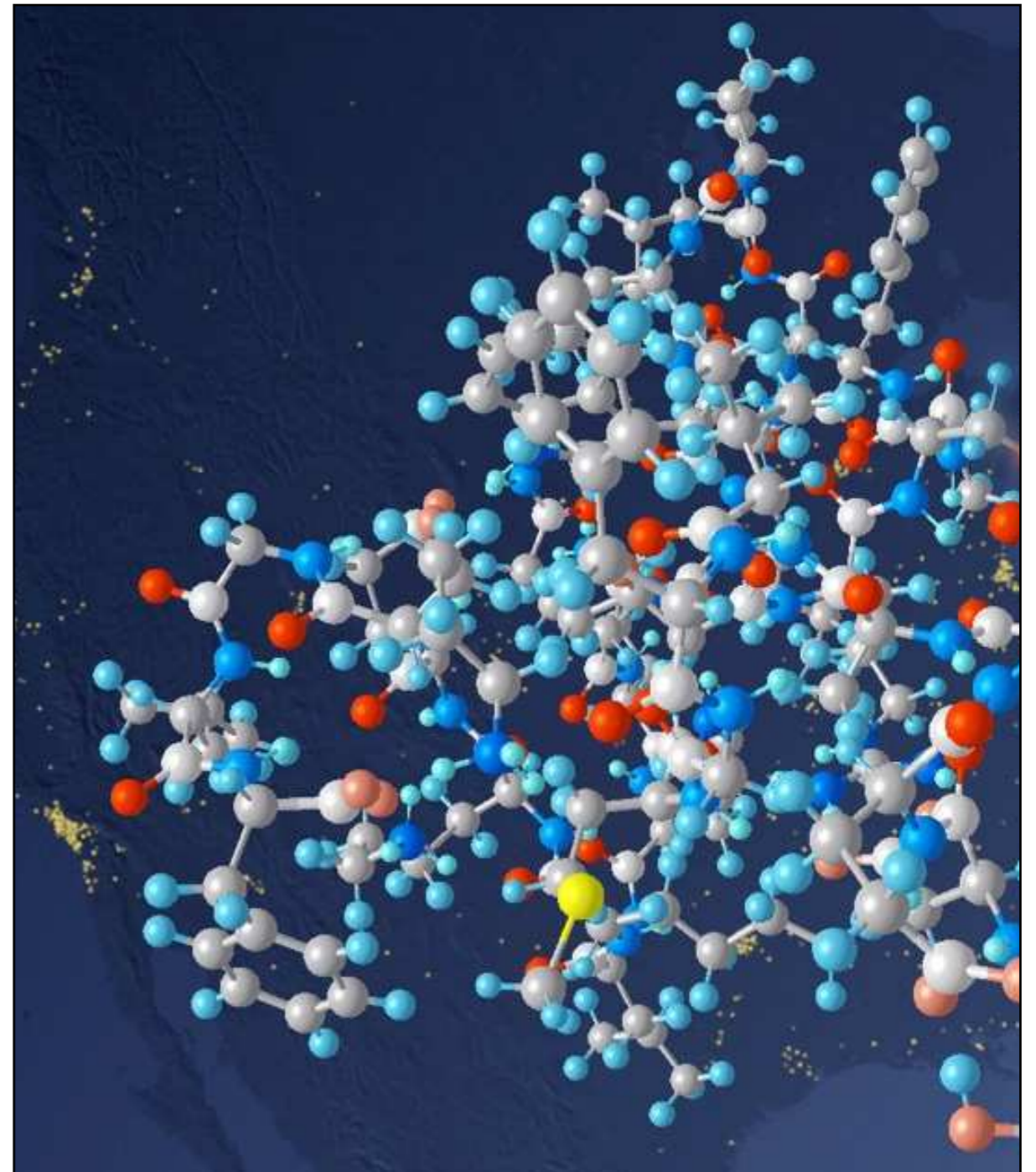
A. Gadani

broad project goals

- what shapes of fishes are most vulnerable to fishing pressure and extinction?
- have certain groups experienced particularly fast or slow shape evolution?
- do certain body shapes evolve more frequently in certain types of environments?
- **need lots of data to do this!**

revolution of “big data”

- next-gen sequencing
- cluster computing (CIPRES, etc.)
- folding@home
- **problem:** collecting data at scale is difficult



amazon mechanical turk™

Artificial Artificial Intelligence

- folding@home for brains
- pay money to harness human “compute time”
- easy for humans, hard for computers

Enter Postmark & Stamp Information for this card



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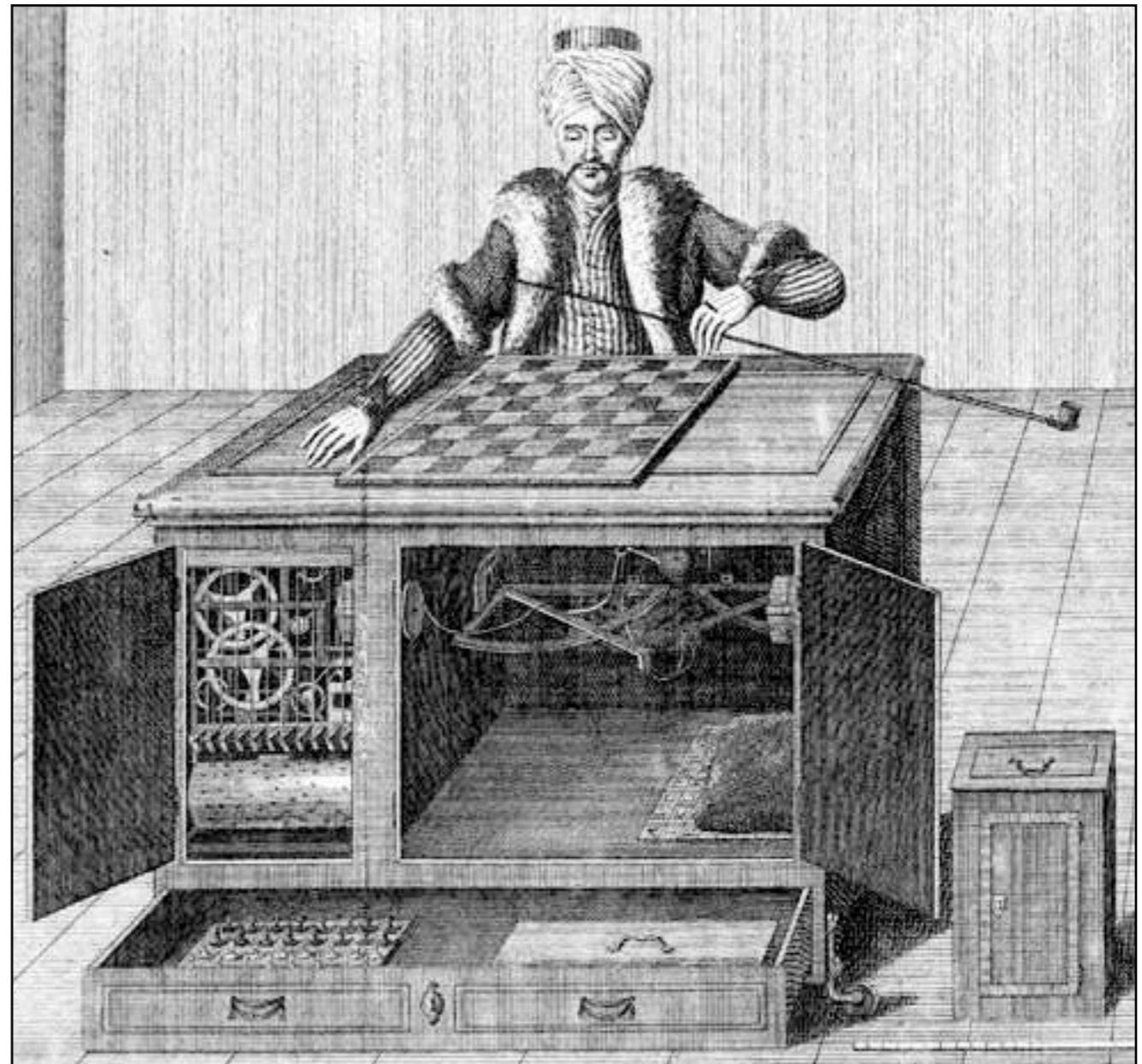
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amazon mechanical turk™

Artificial Artificial Intelligence

- you only pay for acceptable work
- distribute tasks via the Internet
- use an easy protocol: complexity increases cost in time and money



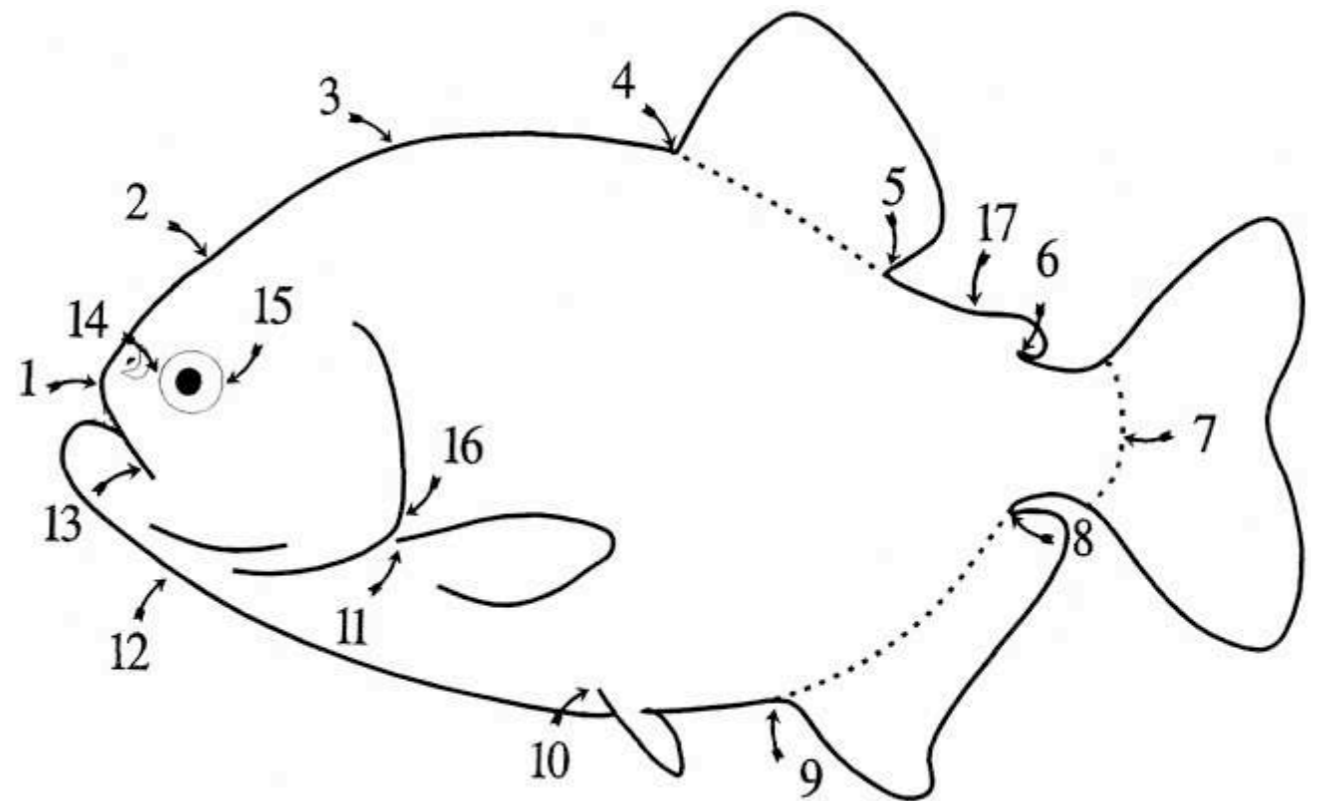
the original mechanical turk

traditional vs. crowdsourcing

- specimen is right in front of you
- can carefully design and execute a protocol

- can only see an online photograph
- follow a protocol, with little feedback

can untrained workers identify (a subset of) landmarks?




- **A small pilot study:** 5 species of triggerfishes
- 9 replicated landmarks compared to a reference
- total cost: \$3.87 (8c each, plus amazon's cut)


Mark key points of a fish image

Please [read the instructions](#) before you start! Keyboard shortcuts: Use **f** to advance to the next tool, or use a specific shortcut to jump to that group (**m e t d a c**)

M1 M2 M3 E1 P1 P2 D1 D2 A1 A2 C1 C2 C3 C4



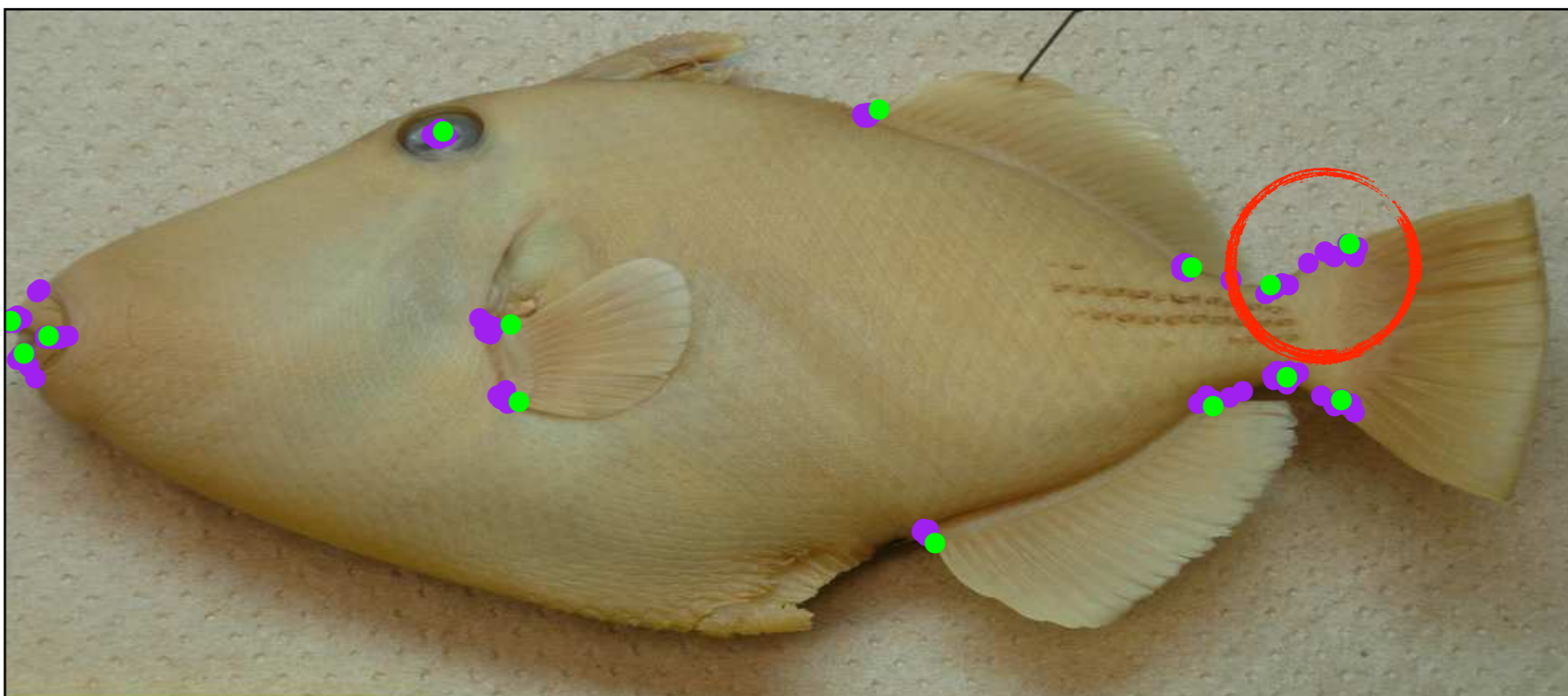
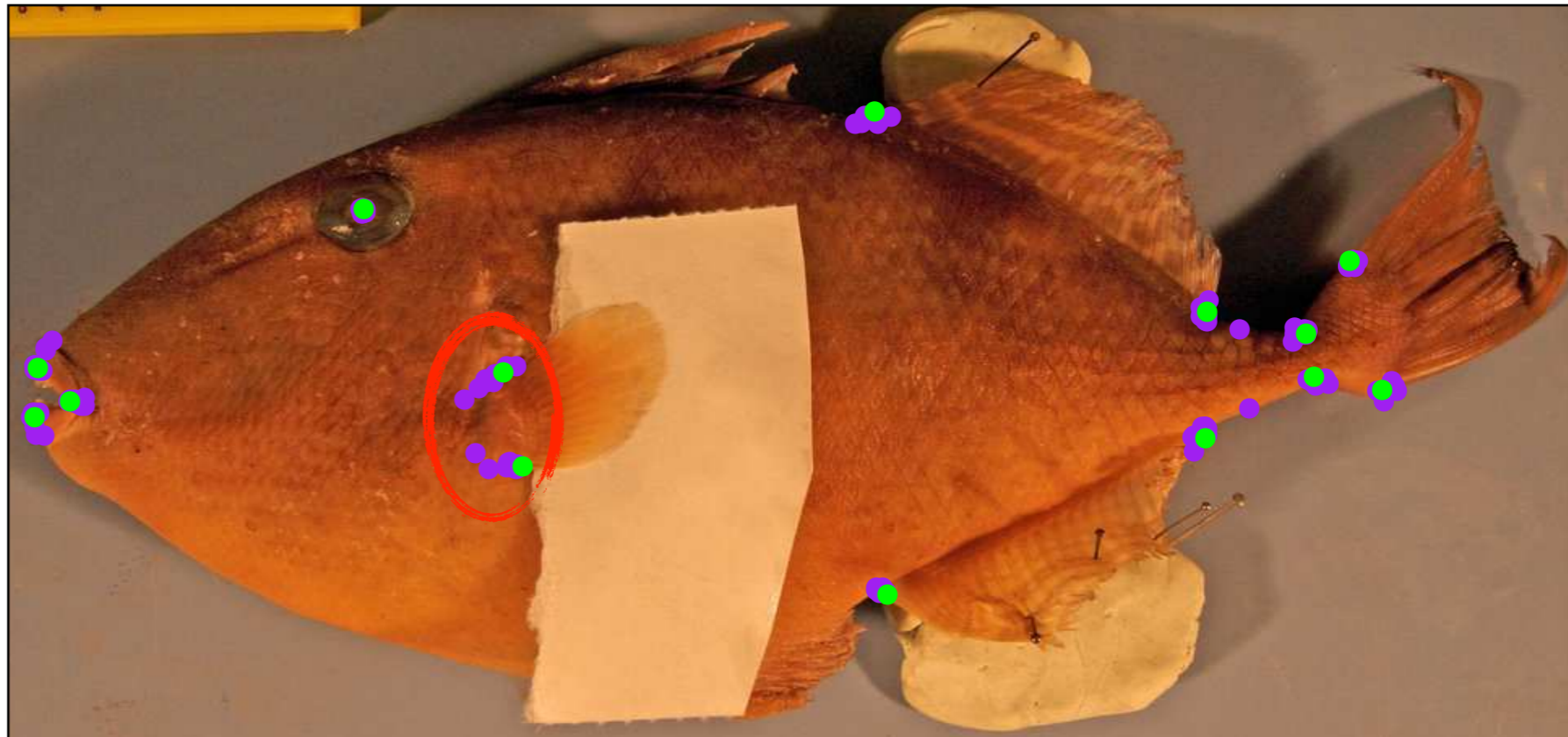
Help



(M1) Mark the front upper tip of the mouth opening. (shortcut: m)

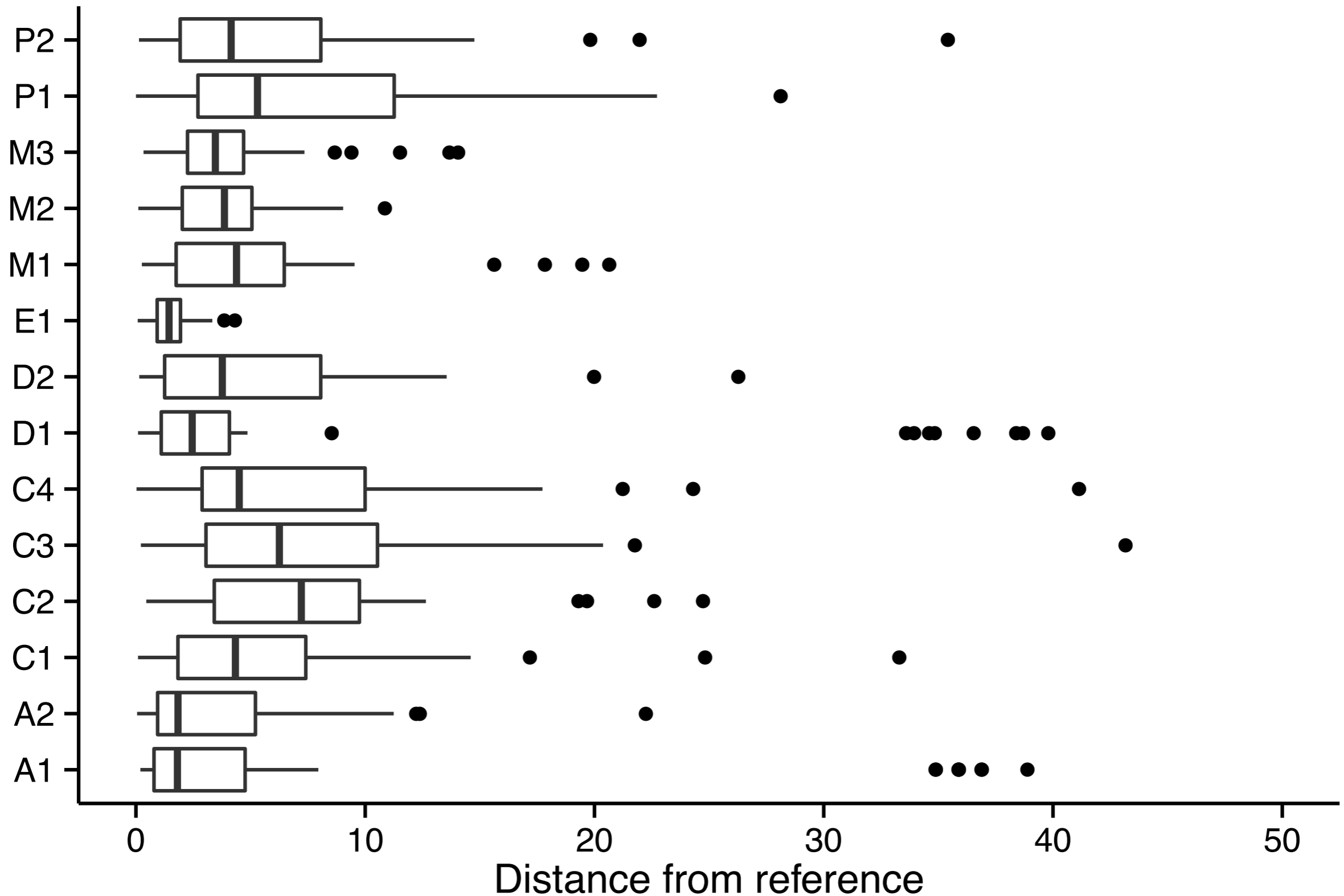
results: timing / quality

- got data 1-30 mins after submission
- only 1/45 didn't follow protocol
- some problem areas



results: consistency

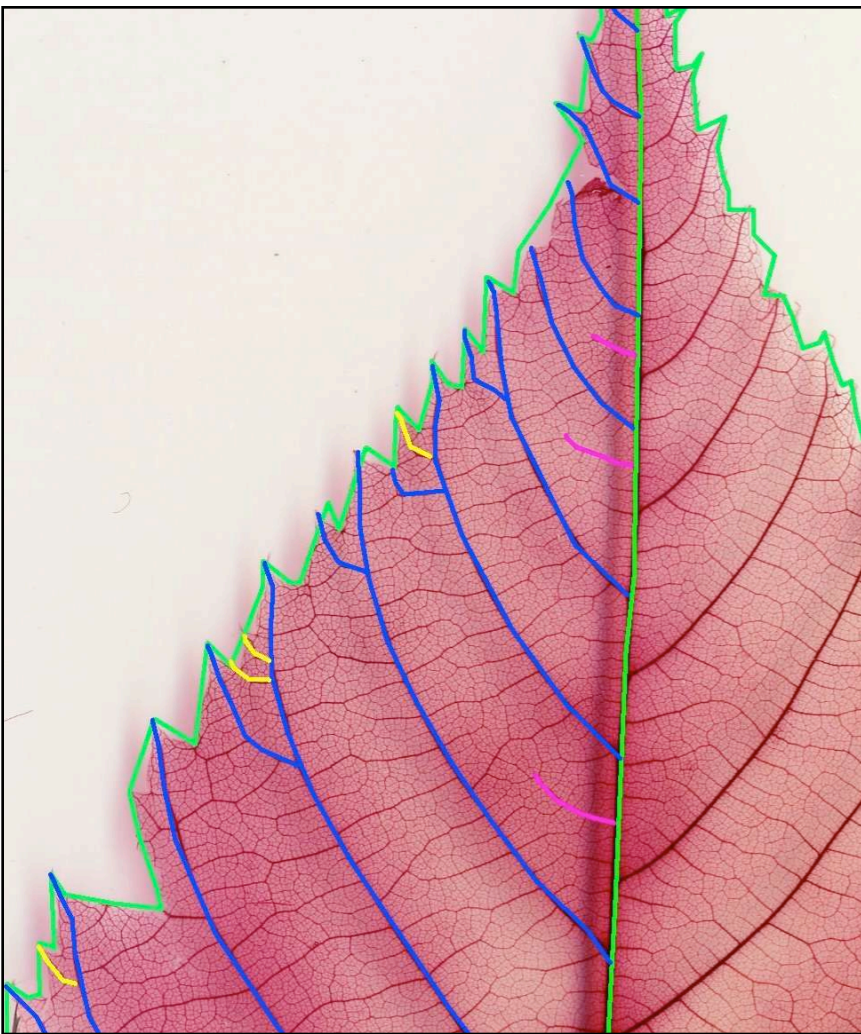
- some landmarks easier to find than others



summary

- can use untrained workers to quantify shapes
- simple protocols reduce systematic error
- less-than-accurate landmarks can still produce good, useful results

other applications?



leaf vein traces



species tracking



your biological
problem!

thanks for listening!

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Funding sources:



Encyclopedia of Life

