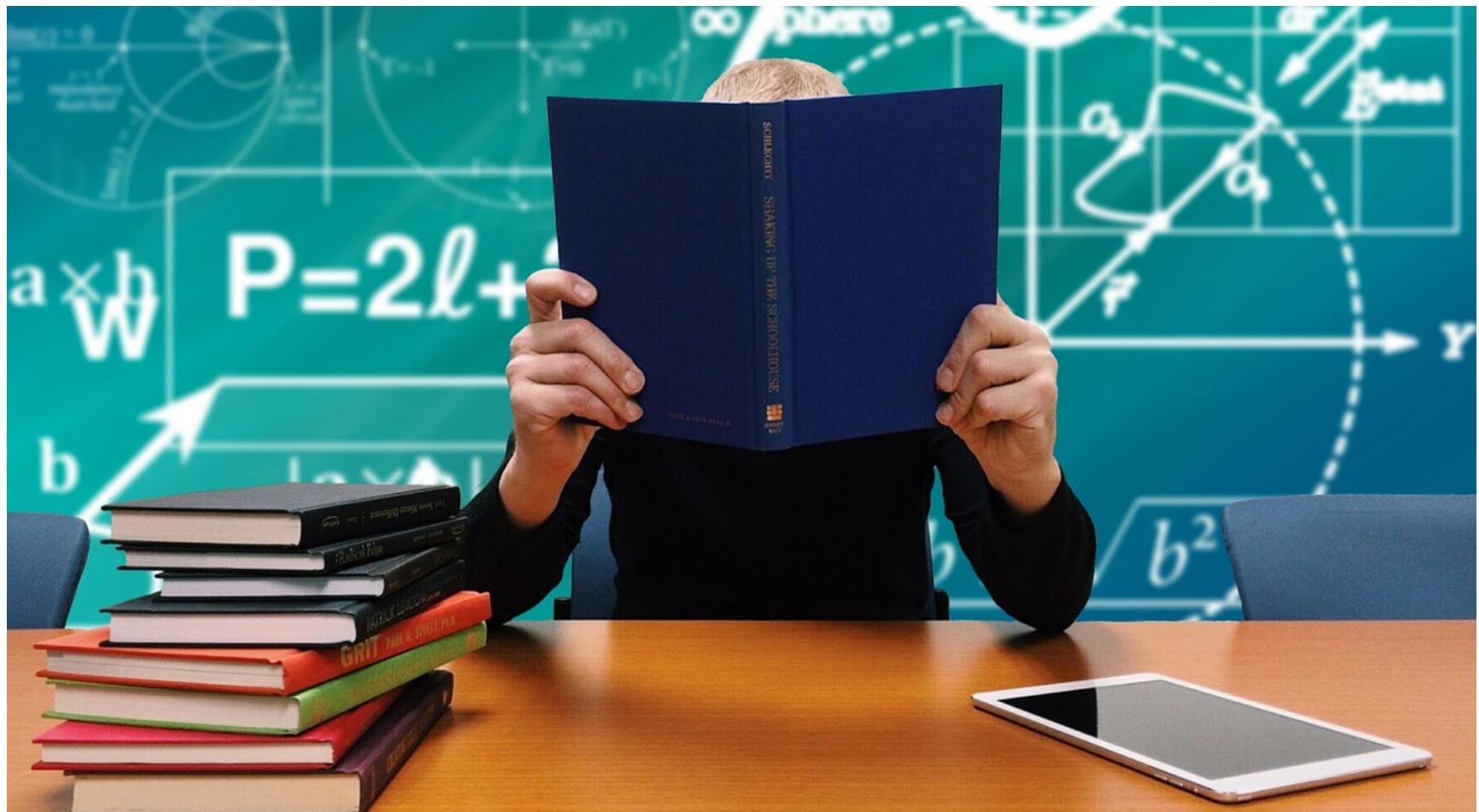


Democratizing and supporting software development: a pathway to sustainable software

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Research driven software

Software developed in pursuit of a
research question

Software as a Service

Number of people with problem	Many
Understanding of problem	Good
Need for users to understand software implementation	Low

	Software as a Service	Research Driven Software
Number of people with problem	Many	1 to not-that-many
Understanding of problem	Good	Low at start
Need for users to understand software implementation	Low	High

Software *Not* as a Service

We must value the skills and the
people as integral to the research
process.

In a world of almost infinite
data, code and software is
what turns data into
information & knowledge

If we in academia want to stay
in the discovery game, we
cannot outsource our software
development or have our
people's best career options be
analysis of click rates

Cultural change!



What can we do now to support
software not as a service?

1. Build local talent
2. Support development
3. Collaborate

Build local talent





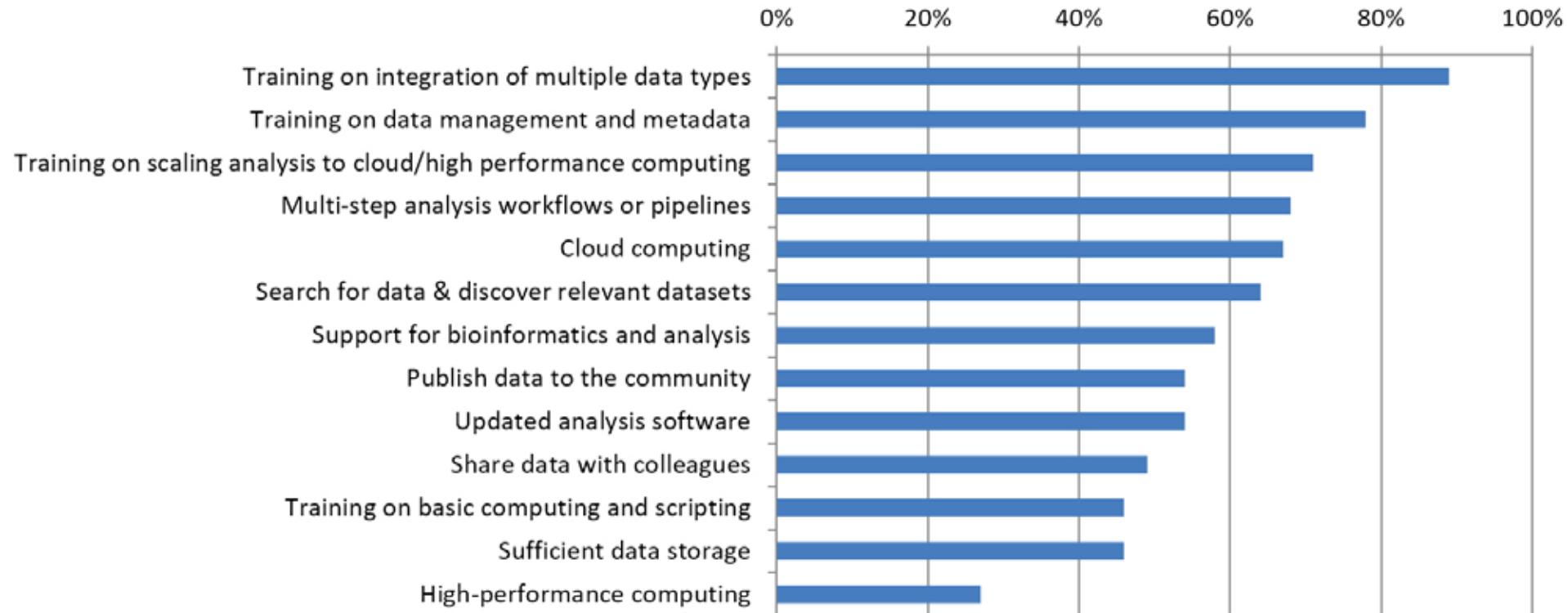
Current researchers

- Understand the research problem
- Have the ability to learn new things
- Motivated to answer the questions
- Have computational skills

Most useful thing Bioinformatics Resource Australia could do is offer training



Current unmet needs



Barone L, Williams J and Micklos D. **Unmet Needs for Analyzing Biological Big Data: A Survey of 704 NSF Principal Investigators (2017)**

What do we want? Training!
When do we want it? Now!



Training in the gaps

Training in the Gaps

- Workshops
- Short courses
- Self-guided learning
- MOOCs
- Integration into existing courses

Training in the Gap

- Active researchers and employees are learning these skills "on the job".
- Need to develop and deliver training that fits their time and needs.
- Training that is immediate, accessible, appropriate for their level and relevant to their domain.
- Include not only technical skills, but also ways of thinking about data and knowing what's possible
- Opportunity for deliberate practice, hands-on training with feedback during learning
- Researchers need to build confidence and the belief that they are capable of computational work, self-efficacy



Software and Data Carpentry

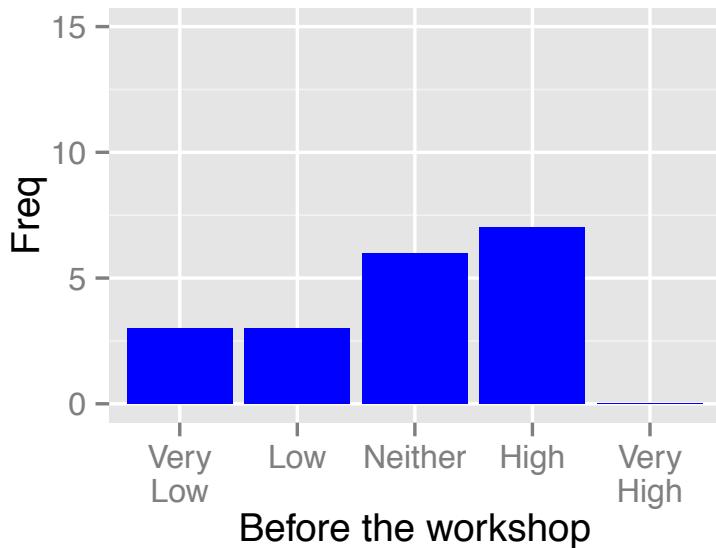


Community organizations training researchers in best practices for data analysis and software development to make research more effective and reproducible.

- Core skills for effective research computing
- Two-day hands-on workshops
- Collaboratively developed, openly licensed lesson materials
- Over 700 trained volunteer instructors on 6 continents

People learn things and like the workshops

Level of data management and analysis skills prior to the workshop



Rate your level of data management and analysis skills following the workshop

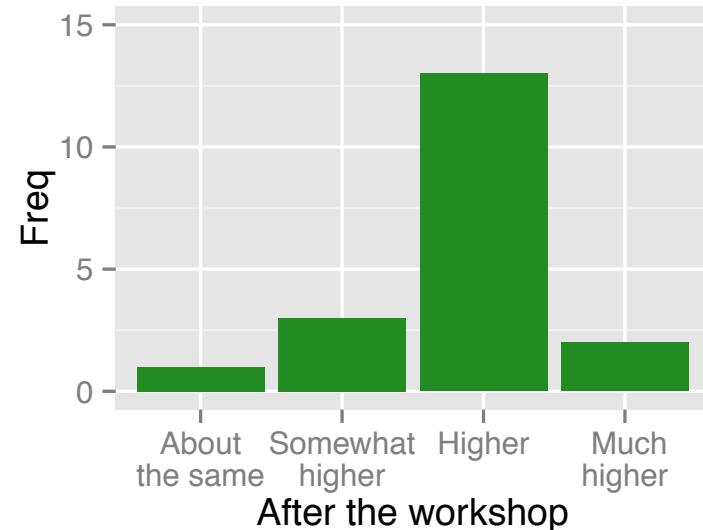


Figure 5: The workshop was worth my time
(n = 419)

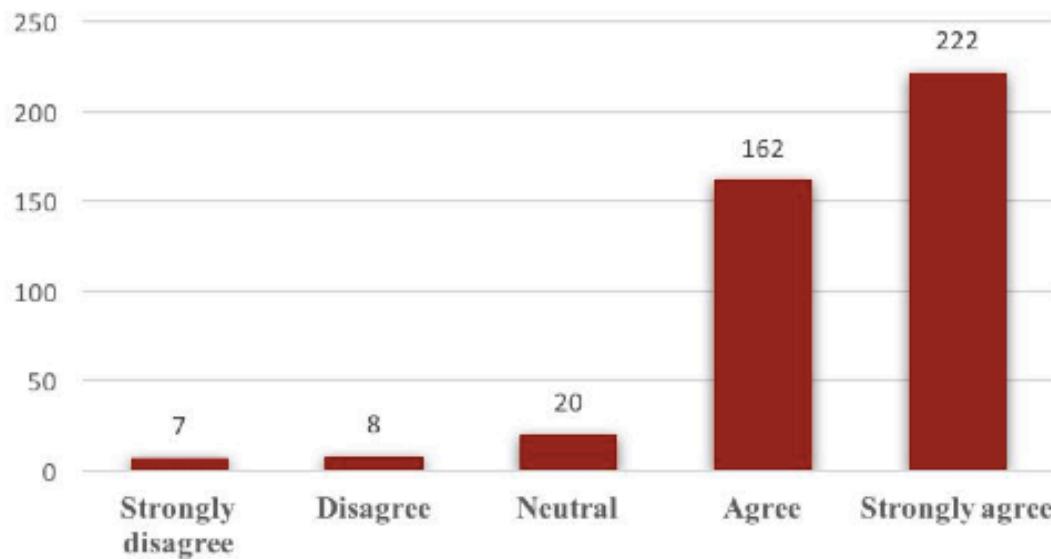
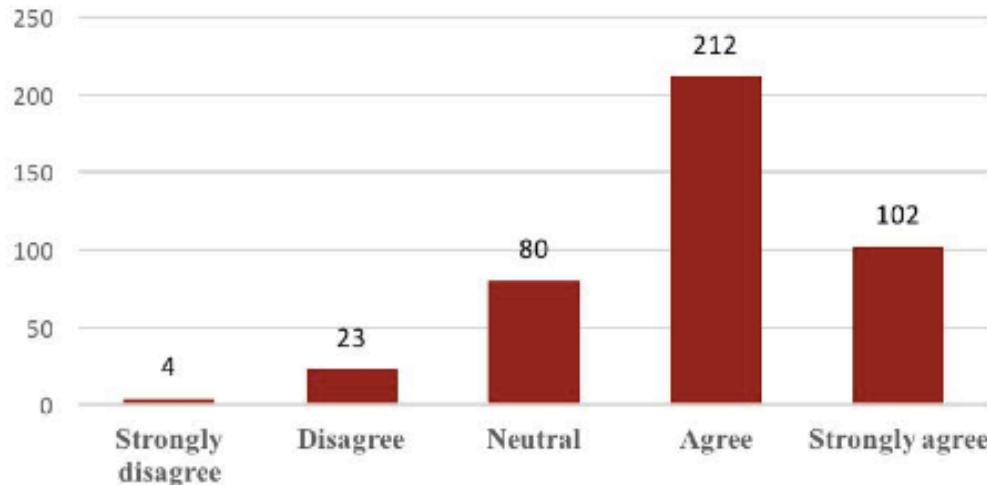
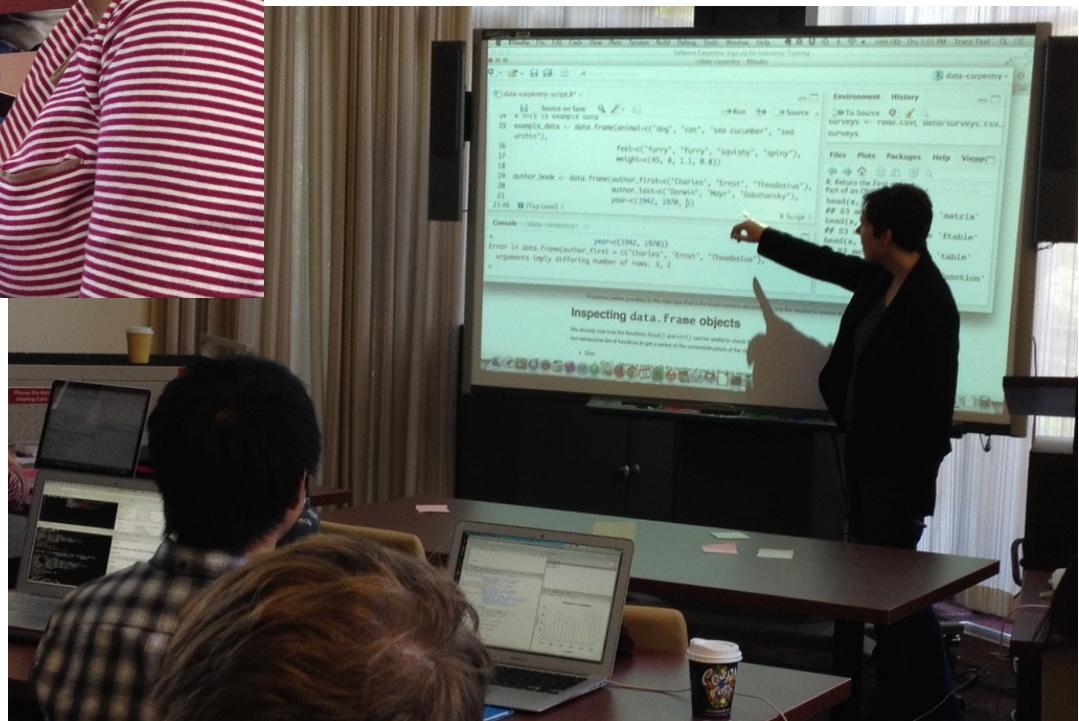


Figure 6: I can immediately apply what I learned at the workshop.
(n = 421)



Democratizing data skills

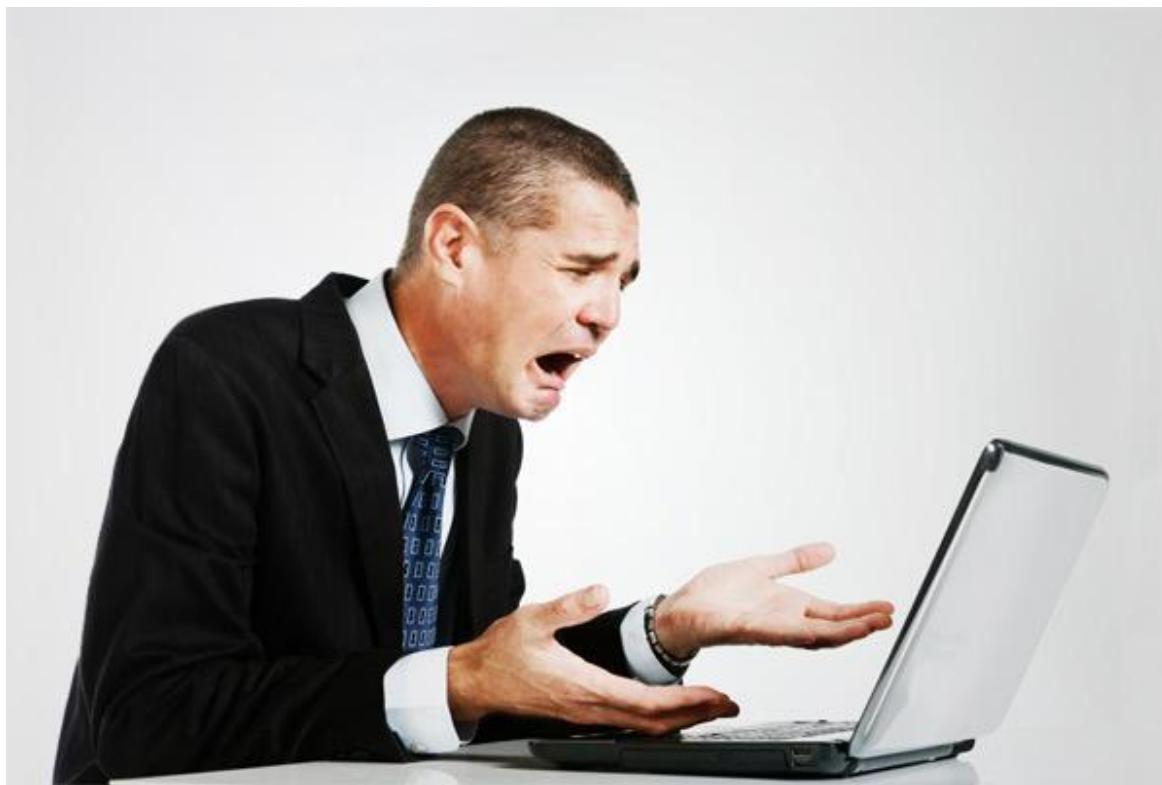


Democratizing data skills

- Answer more questions
- Engage a more diverse set of researchers in computational analysis
- More creative approaches and questions
- Everyone wins!

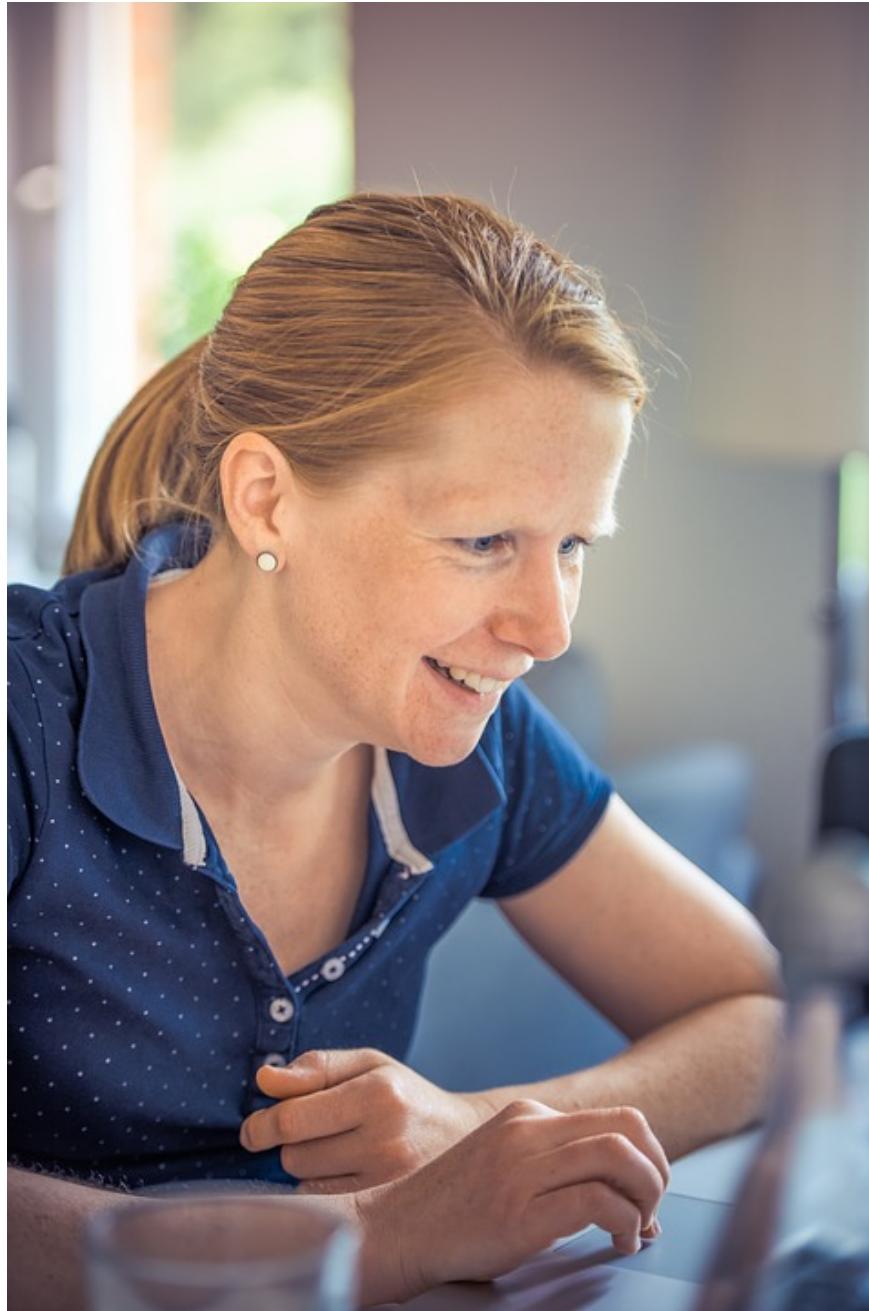
Our “money ball” is not identifying underappreciated talent, but creating a program that builds talent

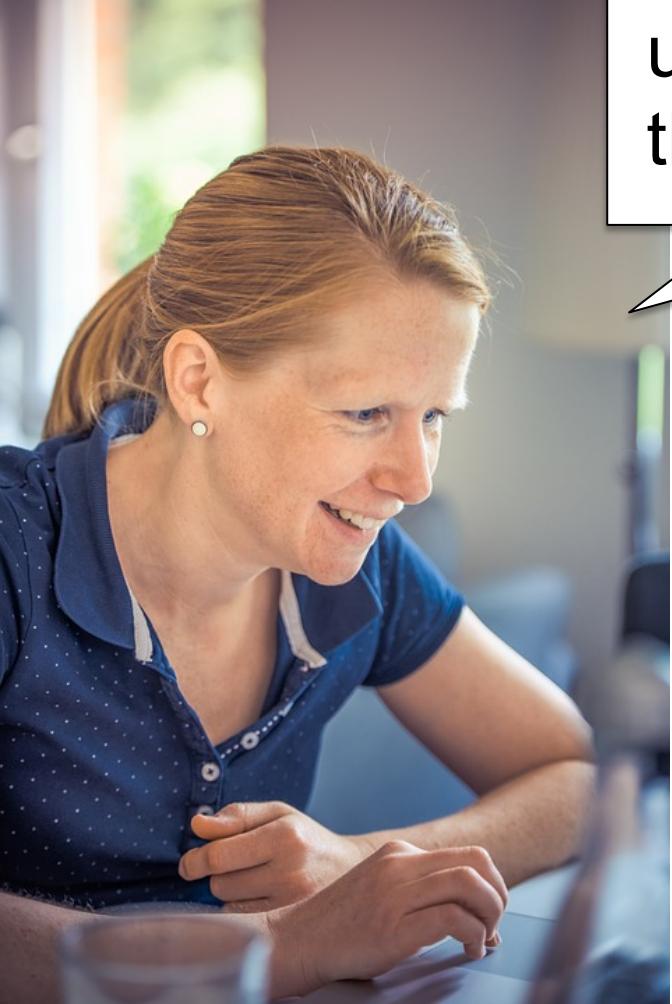
2. Supporting development



A photograph of a man in a dark suit and tie, sitting at a desk and screaming intensely at an open laptop. He has his mouth wide open and hands gesturing towards the screen. A large speech bubble originates from his mouth, containing the text.

Why is git telling
me I have a
detached head!?





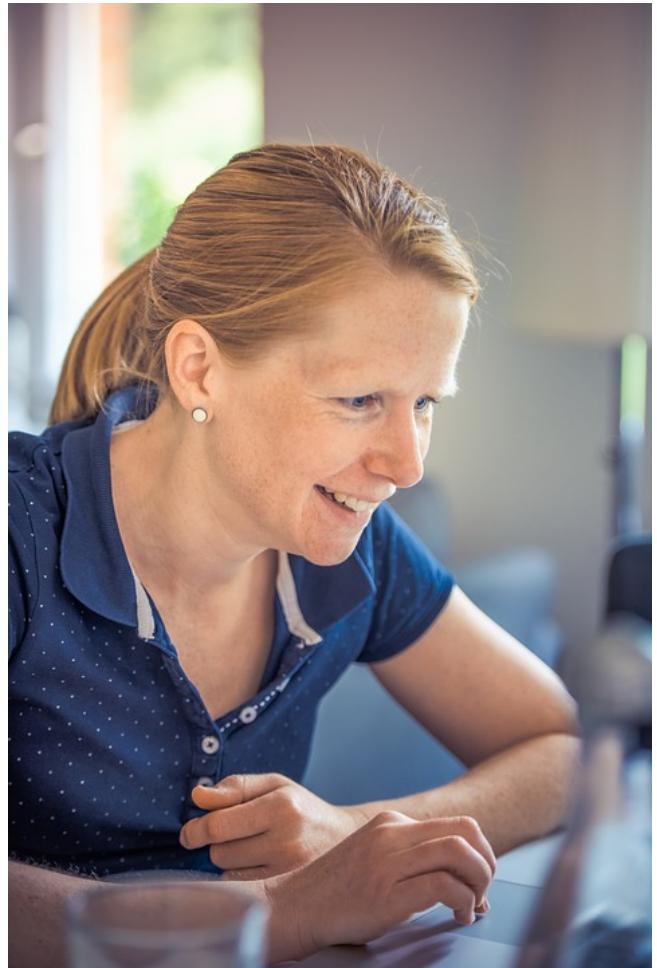
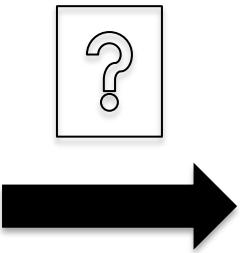
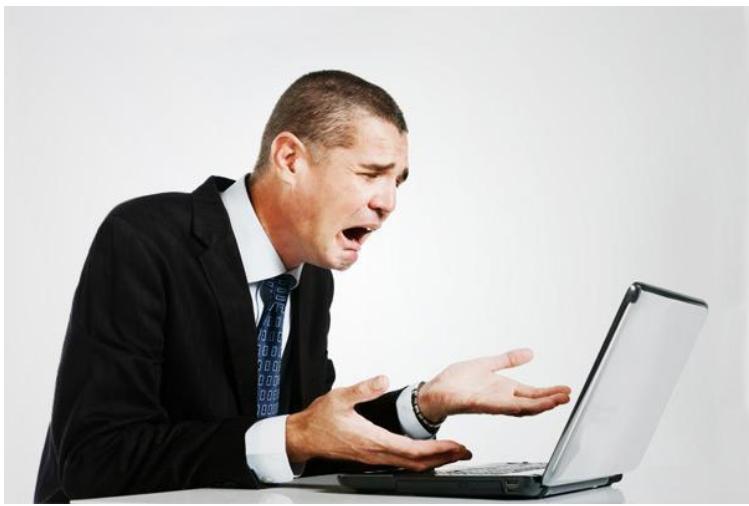
Git makes sense to
me now that I
understand the theory
that underlies it!

THIS IS GIT. IT TRACKS COLLABORATIVE WORK
ON PROJECTS THROUGH A BEAUTIFUL
DISTRIBUTED GRAPH THEORY TREE MODEL.

COOL. HOW DO WE USE IT?

NO IDEA. JUST MEMORIZIZE THESE SHELL
COMMANDS AND TYPE THEM TO SYNC UP.
IF YOU GET ERRORS, SAVE YOUR WORK
ELSEWHERE, DELETE THE PROJECT,
AND DOWNLOAD A FRESH COPY.





Supporting development

- Software development consulting services
- Information or access to resources on best/better practices (Checklists! Templates!)
- Opportunities to learn from each other (paired programming, lab code review)
- Valuing the time it takes to learn the skills and do software development well
- Giving credit for software & good software development practices



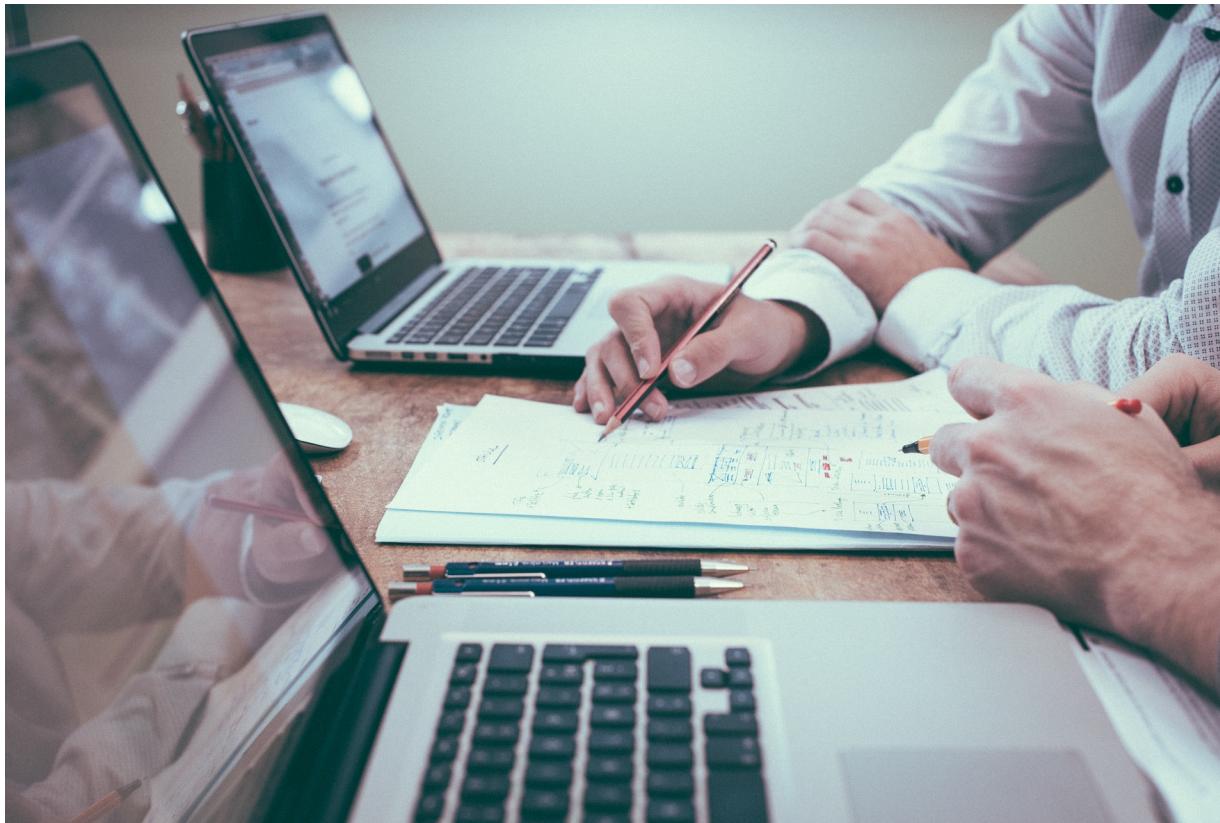
Journal of Open Source Software

The Journal of Open Source Software (JOSS) is a **developer friendly** journal for research software packages.

Author Guidelines

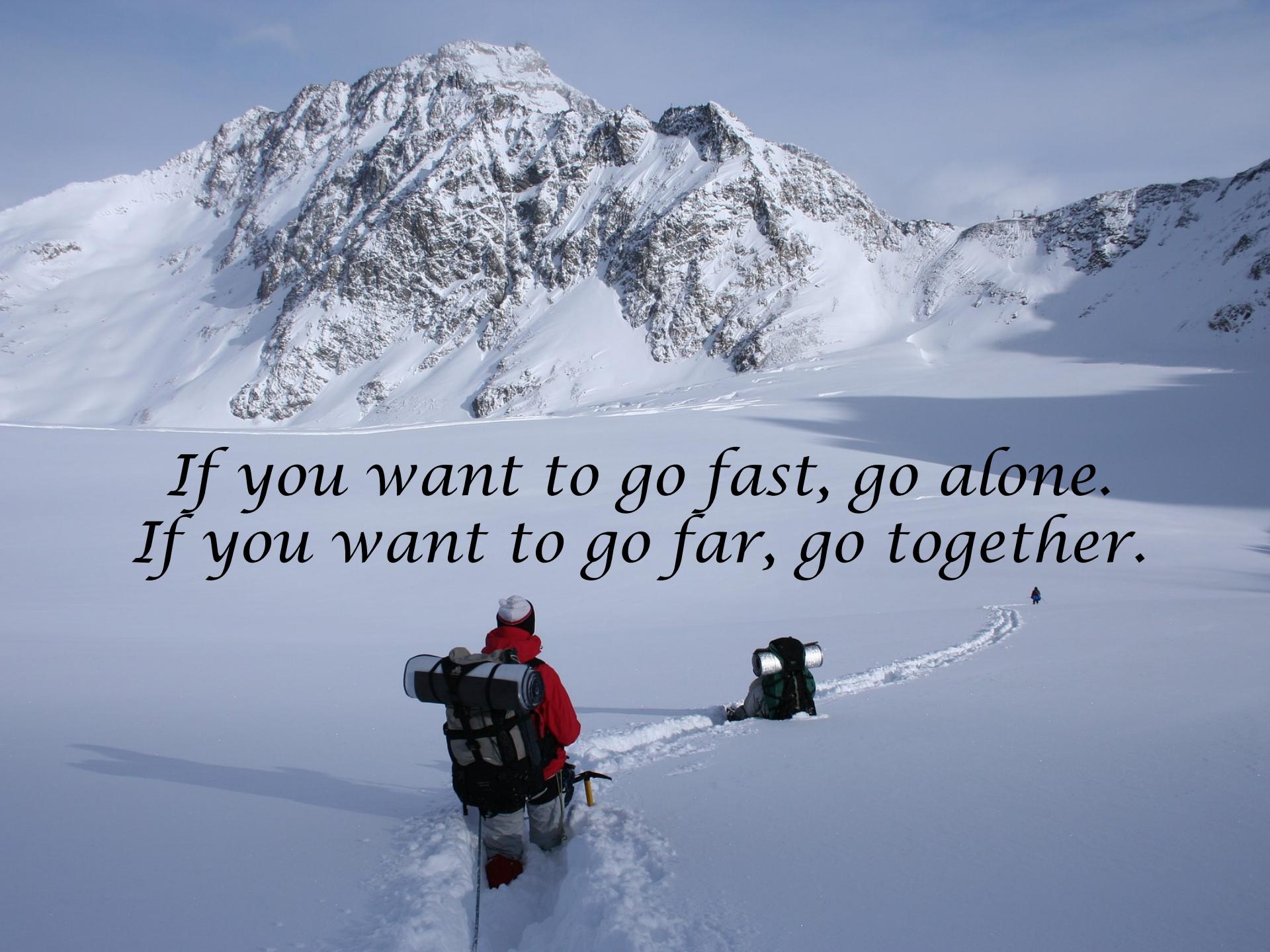
If you've already licensed your code and have good documentation then we expect that it should take **less than an hour** to prepare and submit your paper to JOSS.

Software development consulting services



3. Collaborate

As scientists, we are people
who put science above self to
advance research progress

The background features a majestic, snow-covered mountain range under a clear blue sky. In the foreground, two hikers are walking away from the camera on a bright, snow-laden path. The hiker on the left wears a red jacket and a white knit hat, carrying a large black backpack. The hiker on the right wears a green jacket and a dark knit hat, also carrying a large black backpack. A third person is visible in the distance further up the trail.

*If you want to go fast, go alone.
If you want to go far, go together.*



If you want to go fast, go alone.
If you want to go in a lot of different
uncoordinated directions at once, go together.

Collaborate

- Open code
- Open data
- Communication
 - Shared knowledge
 - Ideas from different perspectives
- Building a community of practice: in our labs, at our universities, across universities



Software and Data Carpentry

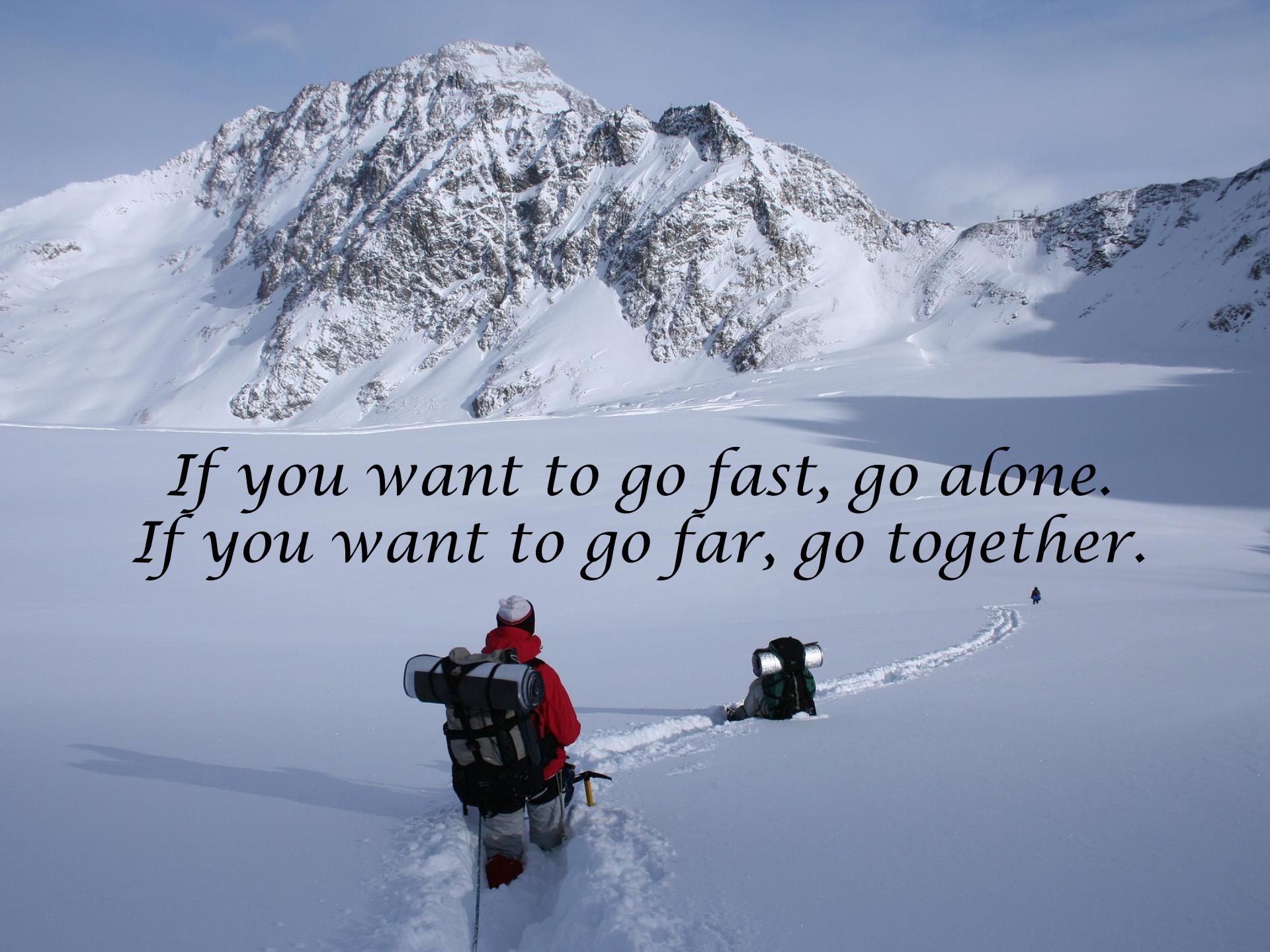


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