User & Developer Survey 2023
Andrew Claster
Methodology

We conducted 1,329 interviews online among Julia users and developers May 27 – July 4, 2023

Margin of error is +/- 2.7 percentage points

We recruited respondents online using Slack, Discourse, Forem, Twitter, LinkedIn, email, JuliaLang.org and JuliaHub.com

The survey was administered in 6 languages: English, Chinese (Simplified and Traditional), Japanese, Korean and Spanish

This is the fifth annual Julia User & Developer Survey we have conducted

Many of the questions and answer choices are the same from year-to-year so we have shown tracking data from previous years where that is the case

Many of the questions and answer choices are new or updated based on new developments, previous results or feedback from the community. This is identified where it is relevant to the interpretation of results.
Julia Use Has Increased Among Julia Users & Developers This Year; Most Other Languages Are Down

Which of the following languages have you used regularly or frequently during the past year?

- Julia: 88% (2022), 85% (2023)
- Python: 67% (2022), 57% (2023)
- Bash, Shell, PowerShell: 42% (2022), 38% (2023)
- C, C++: 27% (2022), 23% (2023)
- MATLAB: 19% (2022), 17% (2023)
- R: 20% (2022), 16% (2023)
- SQL: 19% (2022), 14% (2023)
- Java: 18% (2022), 13% (2023)
- JavaScript: 13% (2022), 11% (2023)
- Rust: 6% (2022), 7% (2023)
- Mathematica: 7% (2022), 6% (2023)
- Fortran: 8% (2022), 6% (2023)
- Typescript: 4% (2022), 4% (2023)
- C#: 3% (2022), 3% (2023)
- Go: 4% (2022), 2% (2023)
- Octave: 4% (2022), 2% (2023)
Julia Users Plan to Use More Julia and Rust Next Year and Less Python, MATLAB and Other Languages

Which of the following languages have you used regularly or frequently during the past year?
Which of the following languages do you plan to use regularly or frequently during the next year?

<table>
<thead>
<tr>
<th>Language</th>
<th>Past Year</th>
<th>Next Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Julia</td>
<td>91%</td>
<td>88%</td>
</tr>
<tr>
<td>Python</td>
<td>57%</td>
<td>52%</td>
</tr>
<tr>
<td>Bash, Shell, PowerShell</td>
<td>38%</td>
<td>33%</td>
</tr>
<tr>
<td>C, C++</td>
<td>23%</td>
<td>21%</td>
</tr>
<tr>
<td>MATLAB</td>
<td>17%</td>
<td>13%</td>
</tr>
<tr>
<td>R</td>
<td>16%</td>
<td>10%</td>
</tr>
<tr>
<td>SQL</td>
<td>13%</td>
<td>10%</td>
</tr>
<tr>
<td>Java</td>
<td>14%</td>
<td>13%</td>
</tr>
<tr>
<td>JavaScript</td>
<td>13%</td>
<td>11%</td>
</tr>
<tr>
<td>Rust</td>
<td>7%</td>
<td>13%</td>
</tr>
<tr>
<td>Mathematica</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>Fortran</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Typescript</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>C#</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Go</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Octave</td>
<td>2%</td>
<td>2%</td>
</tr>
</tbody>
</table>
80% Say Julia Is ‘One of My Favorite Languages’ – Highest Ever
Python Has Been Declining Among Julia Users Since 2019

How much do you like each of the following languages?

<table>
<thead>
<tr>
<th>Year</th>
<th>Julia</th>
<th>Python</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>93%</td>
<td>61%</td>
</tr>
<tr>
<td>2020</td>
<td>93%</td>
<td>35%</td>
</tr>
<tr>
<td>2021</td>
<td>93%</td>
<td>26%</td>
</tr>
<tr>
<td>2022</td>
<td>92%</td>
<td>20%</td>
</tr>
<tr>
<td>2023</td>
<td>92%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Other languages not shown include C/C++ (27% ‘one of my favorite languages’ + ‘like’), Rust (22% ‘one of my favorite languages’ + ‘like’), Bash/Shell/PowerShell (17% ‘one of my favorite languages’ + ‘like’), MATLAB (16% ‘one of my favorite languages’ + ‘like’), R (15% ‘one of my favorite languages’ + ‘like’), and SQL (14% ‘one of my favorite languages’ + ‘like’).
The MOST Popular TECHNICAL Features of Julia Are Speed/Performance, Ease of Use, Open Source, Package Manager, Multiple Dispatch, Solves Two Language Problem, Composable

Thinking only about the TECHNICAL aspects or features of Julia, what are the TECHNICAL aspects or features you like MOST about Julia?

- Speed, performance
- Ease of use
- Open source - code is available and can be modified
- Package manager
- Multiple dispatch
- Solves the two language problem
- Composable
- Ease of installation
- Type system
- Specific package(s)
- Distributed / GPU computing
- Editor and IDE support (Emacs, Vi, Juno, VS Code)
- Metaprogramming
- On-e-based indexing
- Integrates well with other language(s)

Biggest increase: package manager

* Added in 2020
** Added in 2021
*** Added in 2022
The MOST Popular NON-TECHNICAL Features of Julia Are Free (Don’t Have to Pay) and the Julia Community

Thinking only about the NON-TECHNICAL aspects or features of Julia, what are the NON-TECHNICAL aspects or features you like MOST about Julia?

- Free - don’t have to use Julia: 81% (2022), 80% (2021), 79% (2020), 78% (2019), 77% (2018)
- Julia community of developers is talented and active: 69% (2022), 70% (2021), 67% (2020), 66% (2019)
- Julia community of developers is warm and welcoming: 46% (2022), 48% (2021), 46% (2020), 46% (2019)
- Easy to create packages: 34% (2022), 35% (2021), 34% (2020), 34% (2019)
- MIT license: 35% (2022), 36% (2021), 37% (2020), 37% (2019)
- Easy to get help and information online: 32% (2022), 34% (2021), 34% (2020), 37% (2019)
- Great documentation: 28% (2022), 31% (2021), 34% (2020), 36% (2019)
- Easy to contribute to the language: 18% (2022), 18% (2021), 18% (2020), 18% (2019)
- Lots of great teaching and learning resources available online: 18% (2022), 17% (2021), 18% (2020), 18% (2019)

** Added in 2021
The Biggest TECHNICAL PROBLEMS with Julia Are Cannot Generate Self-Contained Binaries or Libraries and Slow Compile Times – Too Long to Generate First Plot

Thinking only about the TECHNICAL aspects or features of Julia, what are the TECHNICAL aspects or features you like LEAST about Julia?

- Cannot generate self-contained binaries or libraries such as .exe, .dll, .so, etc. (48% in 2023, compared to 41% in 2020)
- Slow compile times - for example, it takes too long to generate the first plot (46% in 2023, compared to 42% in 2020)
- Confusing or overly verbose error messages (46% in 2023, compared to 42% in 2020)
- I require packages, libraries or tools that are only available or are more complete in another language (25% in 2023, compared to 24% in 2020)
- The debugger is too slow and/or not fully featured (21% in 2023, compared to 19% in 2020)
- Poor inter, poor syntax checking compared to statically typed languages (18% in 2023, compared to 17% in 2020)
- No built-in support for interfaces or traits (16% in 2023, compared to 15% in 2020)
- Immature (Added after 2020: not ready for use in production) (15% in 2023, compared to 13% in 2020)
- Poor editor and IDE support (14% in 2023, compared to 13% in 2020)
- Writing performant code is difficult and requires specialized knowledge (13% in 2023, compared to 12% in 2020)
- Slow garbage collection (13% in 2023, compared to 12% in 2020)
- No in-language or built-in support for mutable, fixed-size arrays (10% in 2023, compared to 9% in 2020)
- Bugs (9% in 2023, compared to 8% in 2020)
- One-based indexing (8% in 2023, compared to 7% in 2020)
- Does not integrate well with other languages (4% in 2023, compared to 3% in 2020)

* Added in 2020
** Added in 2021
*** Added in 2022
**** Added in 2023
***** In 2023, ‘slow compile times’ and ‘it takes too long to generate the first plot’ were combined. Previous years’ data is for ‘it takes too long to generate the first plot’.

Removed in 2023: Packages aren’t as mature or as well-maintained as I need, doesn’t have all the packages I need, not well-suited to certain tasks, not stable enough, package manager is confusing, difficult or doesn’t do what I expect.
The Biggest NON-TECHNICAL PROBLEM with Julia Is Related to Adoption: Not Enough Julia Users

Thinking only about the NON-TECHNICAL aspects or features of Julia, what are the NON-TECHNICAL aspects or features you like LEAST about Julia?

- There are not enough Julia users in my field or industry
- Online tutorials and documentation are outdated* (or insufficient ****)
- My company, university, clients or other organizations I work with do not allow or support Julia*
- I feel that the Julia developer team does not communicate its plans or intentions clearly enough
- I am more comfortable in another language
- Julia community is not active enough
- Julia community is not diverse enough***
- The Julia community is too conservative and too reluctant to make useful changes to the language***
- Julia community is too closed and not welcoming enough

* Added in 2020
*** Added in 2022

Removed in 2023: My colleagues, company or collaborators use other languages, there are not enough Julia users in general, insufficient documentation, there are not enough teaching and learning resources available online, there are too many things I don’t know how to do in Julia.
Reasons for Choosing Julia: Seems Like the Language of the Future, Elegance, Speed, Solves the Two Language Problem, Like Learning New Languages, Preferable Syntax

<table>
<thead>
<tr>
<th>Reason</th>
<th>2023</th>
<th>2022</th>
<th>2021</th>
<th>2020</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Julia seems like the language of the future</td>
<td>61%</td>
<td>63%</td>
<td>63%</td>
<td>61%</td>
<td>55%</td>
</tr>
<tr>
<td>Elegance of Julia**</td>
<td>57%</td>
<td>53%</td>
<td>53%</td>
<td>52%</td>
<td>48%</td>
</tr>
<tr>
<td>Faster for the work I am doing</td>
<td>46%</td>
<td>46%</td>
<td>44%</td>
<td>46%</td>
<td>50%</td>
</tr>
<tr>
<td>Julia solves the two language problem**</td>
<td>46%</td>
<td>46%</td>
<td>44%</td>
<td>46%</td>
<td>50%</td>
</tr>
<tr>
<td>I like learning new languages</td>
<td>43%</td>
<td>43%</td>
<td>42%</td>
<td>43%</td>
<td>40%</td>
</tr>
<tr>
<td>Preferable syntax to other language</td>
<td>43%</td>
<td>43%</td>
<td>42%</td>
<td>43%</td>
<td>40%</td>
</tr>
<tr>
<td>I heard about Julia from friends or colleagues (2019-20: and I wanted to try it out)</td>
<td>36%</td>
<td>36%</td>
<td>26%</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td>Better packages for the work I am doing</td>
<td>33%</td>
<td>31%</td>
<td>15%</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Colleagues in my field use Julia and I want to collaborate with them</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>My instructor or a course I wanted to take uses Julia</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
</tr>
</tbody>
</table>

** Added in 2021
Removed in 2023: I need or want a specific feature
Julia Users & Developers Interact on GitHub, Discourse, Slack, YouTube and Stack Overflow

Where do you interact with the Julia community?

* GitHub, Discourse, Slack and Discord have grown
* Stack Overflow and Twitter have declined

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** GitHub, Discourse, Slack and Discord have grown
** Stack Overflow and Twitter have declined

***Added in 2022
****Added in 2023

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Most Use Julia for Research, Hobby Programming and Individual Work

Which of the following best describe your use of Julia?

- I use Julia because it is required for classes at my university
- I use Julia in production for a business critical task
- I use Julia for teaching
- I use Julia for development as part of a team
- I use Julia for work individually
- I use Julia for hobby programming***
- I use Julia for research

*** Added in 2022
Users and Developers Are Most Likely to Create or Contribute to Private Packages

2023: Which of the following types of Julia packages have you created or contributed to?
(2022: Which of the following types of Julia packages have you created?
Which of the following types of Julia packages have you contributed to, including documentation or filing issues, but not created?)

- Open source and registered in the Julia general registry: 39% (2022: Created) 41% (2022: Contributed) 44% (2023: Created or Contributed)
- Open source and not registered in the Julia general registry: 15% (2022: Created) 31% (2022: Contributed) 31% (2023: Created or Contributed)
- Private and not registered in a private registry: 18% (2022: Created) 42% (2022: Contributed) 44% (2023: Created or Contributed)
Open-Source Creators and Contributors Are Most Likely to Contribute on a Voluntary Basis or as a Component of Other Paid Work

**IF OPEN SOURCE CREATOR OR CONTRIBUTOR: In which of the following capacities do you contribute to Julia?**

- **Completely voluntary: 50%**
- **Write Julia as a component of other paid work, such as research for academics: 46%**
- **Part paid, part voluntary: 14%**
- **Paid programmer: 11%**
Most Open-Source Creators and Contributors Spend 1-10 Hours Per Week Working on Open Source Julia Projects or the Julia Community

IF OPEN SOURCE CREATOR OR CONTRIBUTOR: How many volunteer hours do you spend working on open source Julia projects or the Julia community per week?

- None: 16%
- 1-10 hours per week: 62%
- 11-20 hours per week: 11%
- More than 20 hours per week: 7%
Most Started Using Julia in the Last 5 Years

When did you first start using Julia?

- 2019
- 2020
- 2021
- 2022
- 2023
Most Julia Users & Developers Do At Least 40% of Their Programming Work in Julia; 30% Do At Least 80% of Their Programming Work in Julia

What percentage of the programming work you do is in Julia?

- 0-19%: 31%, 31%, 31%
- 20-39%: 13%, 14%, 11%
- 40-59%: 12%, 12%, 14%
- 60-79%: 14%, 13%, 14%
- 80-100%: 27%, 24%, 30%
80% Say the Julia Package Ecosystem Is ‘Very’ or ‘Somewhat’ Robust – Up from 73% Last Year

How robust is the current Julia package ecosystem?

- Very: 17% in 2021, 17% in 2022, 20% in 2023
- Somewhat: 57% in 2021, 56% in 2022, 60% in 2023
- Not Very: 13% in 2021, 14% in 2022, 11% in 2023
- Not At All: 1% in 2021, 2% in 2022, 2% in 2023
VS Code, Jupyter, Pluto and Vi/Vim/Neovim Are the Leading Editors or IDEs for Julia Users & Developers

Which editors or IDEs do you use frequently?

<table>
<thead>
<tr>
<th>Editor/IDE</th>
<th>2023</th>
<th>2022</th>
<th>2021</th>
<th>2020</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS Code (2020-21: with Julia plugin)</td>
<td>75%</td>
<td>78%</td>
<td>62%</td>
<td>35%</td>
<td>31%</td>
</tr>
<tr>
<td>Jupyter**</td>
<td>25%</td>
<td>24%</td>
<td>31%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Pluto**</td>
<td>6%</td>
<td>3%</td>
<td>39%</td>
<td>31%</td>
<td>35%</td>
</tr>
<tr>
<td>Vi/Vim/Neovim (2019-2020: Vi/Vim)</td>
<td>14%</td>
<td>12%</td>
<td>26%</td>
<td>27%</td>
<td>25%</td>
</tr>
<tr>
<td>JupyterLab</td>
<td>1%</td>
<td>2%</td>
<td>3%</td>
<td>4%</td>
<td>5%</td>
</tr>
<tr>
<td>Emacs</td>
<td>3%</td>
<td>3%</td>
<td>5%</td>
<td>6%</td>
<td>7%</td>
</tr>
<tr>
<td>Notepad++</td>
<td>3%</td>
<td>5%</td>
<td>7%</td>
<td>9%</td>
<td>14%</td>
</tr>
<tr>
<td>Rstudio</td>
<td>3%</td>
<td>3%</td>
<td>5%</td>
<td>7%</td>
<td>10%</td>
</tr>
<tr>
<td>Sublime Text</td>
<td>3%</td>
<td>5%</td>
<td>7%</td>
<td>10%</td>
<td>14%</td>
</tr>
<tr>
<td>IntelliJ or other JetBrains product (2019-2020: IntelliJ)</td>
<td>3%</td>
<td>5%</td>
<td>7%</td>
<td>10%</td>
<td>14%</td>
</tr>
<tr>
<td>Nano/Pico***</td>
<td>3%</td>
<td>3%</td>
<td>5%</td>
<td>7%</td>
<td>10%</td>
</tr>
<tr>
<td>Kate*</td>
<td>3%</td>
<td>3%</td>
<td>5%</td>
<td>7%</td>
<td>10%</td>
</tr>
<tr>
<td>Juno</td>
<td>3%</td>
<td>3%</td>
<td>5%</td>
<td>7%</td>
<td>10%</td>
</tr>
</tbody>
</table>

* Added in 2020
** Added in 2021

None - I write all my code in the Julia REPL*
Most Users & Developers Do Not Use AI Assistance – Those Who Do Use ChatGPT or GitHub Copilot

What types of AI assistance do you use frequently with Julia?

- ChatGPT: 21%
- GitHub Copilot: 15%
- Other Web-based generative AI: 3%
- None of the above: 68%
Most Use a Local Cluster or No Cloud Solution

<table>
<thead>
<tr>
<th>Cloud Provider</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>58%</td>
<td>57%</td>
<td>56%</td>
<td>51%</td>
<td>49%</td>
</tr>
<tr>
<td>Local cluster*</td>
<td>18%</td>
<td>20%</td>
<td>22%</td>
<td>20%</td>
<td>18%</td>
</tr>
<tr>
<td>AWS</td>
<td>9%</td>
<td>8%</td>
<td>7%</td>
<td>9%</td>
<td>8%</td>
</tr>
<tr>
<td>JuliaHub**</td>
<td>6%</td>
<td>7%</td>
<td>10%</td>
<td>8%</td>
<td>6%</td>
</tr>
<tr>
<td>Other cloud provider*</td>
<td>2%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Google Colab</td>
<td>5%</td>
<td>6%</td>
<td>4%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Google Cloud</td>
<td>4%</td>
<td>5%</td>
<td>3%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>MyBinder**</td>
<td>2%</td>
<td>3%</td>
<td>3%</td>
<td>2%</td>
<td>3%</td>
</tr>
<tr>
<td>Azure</td>
<td>3%</td>
<td>3%</td>
<td>2%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>REPL.it</td>
<td>3%</td>
<td>3%</td>
<td>2%</td>
<td>3%</td>
<td>2%</td>
</tr>
</tbody>
</table>

* Added in 2020
** Added in 2021
62% Say the Julia Community Is Very Helpful and Collaborative – Highest Ever

How helpful and collaborative is the Julia community?

- Very: 47% (2019), 55% (2020), 56% (2021), 58% (2022), 62% (2023)
- Somewhat: 26% (2019), 29% (2020), 29% (2021), 28% (2022), 29% (2023)
- Not very: 3% (2019), 2% (2020), 2% (2021), 2% (2022), 3% (2023)
- Not at all: 1% (2019), 1% (2020), 1% (2021), 0% (2022), 0% (2023)
- Don't know: 16% (2019), 12% (2020), 11% (2021), 10% (2022), 7% (2023)
13% of Respondents Plan to Attend JuliaCon This Year, 16% Will Likely Attend in Future and 44% Would Like to Attend – Highest Since Before the Pandemic

Have you attended or do you plan to attend JuliaCon? Please select all that apply.

|------------|------|------|------|------|------|------|------|------|------|------|


Most Downloaded or Installed Binaries from JuliaLang.org, But the Biggest Increase Is JuliaUp

How did you download and install Julia?
2019-2022: How did you download or install the Julia version you use most frequently?

- **Binaries from JuliaLang.org**
  - 2019: 78%
  - 2020: 70%
  - 2021: 71%
  - 2022: 73%
  - 2023: 67%

- **JuliaUp**
  - 2019: 11%
  - 2020: 37%

- **From my Linux distribution**
  - 2019: 12%
  - 2020: 13%
  - 2021: 12%
  - 2022: 11%

- **I compile Julia from source**
  - 2019: 10%
  - 2020: 12%
  - 2021: 10%
  - 2022: 11%

- **From Homebrew cask on Mac**
  - 2019: 8%
  - 2020: 6%
  - 2021: 7%

- **Official Docker container**
  - 2019: 3%
  - 2020: 4%
  - 2021: 3%

* Added in 2020
Most Still Use Julia with Linux/x86, but Windows and macOS Are Growing

With which operating system(s) do you use Julia?

- **Linux/x86**: 65% (2023), 62% (2022), 65% (2021), 62% (2020), 65% (2019)
- **Windows**: 47% (2023), 48% (2022), 45% (2021), 44% (2020), 40% (2019)
- **macOS/ARM**: 14% (2023), 21% (2022), 5% (2021), 5% (2020), 5% (2019)
- **macOS/x86**: 16% (2023), 13% (2022), 5% (2021), 5% (2020), 5% (2019)
- **Windows with WSL**: 12% (2023), 13% (2022), 5% (2021), 5% (2020), 5% (2019)

* Added in 2020
** Added in 2021
*** Added in 2022
**** Added in 2023
## Most Use Julia Multi-Threading (Threads)

Which kind of parallelism, if any, do you use together with Julia?

<table>
<thead>
<tr>
<th>Parallelism Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Julia multi-threading (Threads)</td>
<td>59%</td>
</tr>
<tr>
<td>GPU computing</td>
<td>25%</td>
</tr>
<tr>
<td>Julia distributed computing (Distributed)</td>
<td>21%</td>
</tr>
<tr>
<td>Tasks/coroutines</td>
<td>21%</td>
</tr>
<tr>
<td>Other distributed computing (e.g. MPI.jl, UCX.jl)</td>
<td>6%</td>
</tr>
<tr>
<td>Other multithreading (e.g. Polyester.jl)</td>
<td>5%</td>
</tr>
<tr>
<td>Large-scale parallel computing (100+ nodes)</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>11%</td>
</tr>
<tr>
<td>None of the above</td>
<td>28%</td>
</tr>
</tbody>
</table>
Nvidia GPUs Are the Most Common Accelerators

Which hardware accelerators, if any, do you use together with Julia?

- None
  - 2023: 42%
  - 2022: 51%
  - 2021: 54%
  - 2020: 50%
  - 2019: 53%

- Nvidia GPU - released 2+ years ago
  - 2023: 24%
  - 2022: 23%
  - 2021: 22%
  - 2020: 20%
  - 2019: 20%

- Nvidia GPU - released in last 2 years
  - 2023: 23%
  - 2022: 20%
  - 2021: 20%
  - 2020: 20%
  - 2019: 20%

- Apple M-Series GPU***
  - 2023: 9%

- AMD GPU
  - 2023: 7%

- Intel GPU****
  - 2023: 5%

- Multiple Nvidia GPUs in one system
  - 2023: 4%

- Distributed cluster of GPUs
  - 2023: 3%

- Quantum computer****
  - 2023: 1%

- Other**
  - 2023: 1%

** Added in 2021
**** Added in 2023
What resources have you found most useful when learning Julia for the first time or when learning how to do something in Julia? Please select all that apply.

- **Julia manual**: 86%
- **JuliaCon presentations**: 64%
- **YouTube tutorials**: 39%
- **Julia books**: 35%
- **Other online courses**: 29%
- **JuliaAcademy**: 10%
- **University courses***: 23%
- **Webinars**: 10%
- **Exercism Julia track**: 6%

*** Online and in-person university courses combined in 2023
Most Respondents Use Data Science, Modeling and Simulation, Statistics and Visualization

<table>
<thead>
<tr>
<th></th>
<th>2023</th>
<th>2022</th>
<th>2021</th>
<th>2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data science</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Modeling and simulation</td>
<td></td>
<td></td>
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<tr>
<td>Statistics</td>
<td></td>
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<tr>
<td>Visualization</td>
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<tr>
<td>Machine learning</td>
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<tr>
<td>Optimization</td>
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<tr>
<td>Scripting**</td>
<td></td>
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<tr>
<td>Differential equations</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Scientific machine learning***</td>
<td></td>
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<tr>
<td>Automatic differentiation****</td>
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<tr>
<td>Graphics</td>
<td></td>
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<tr>
<td>Signal processing</td>
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<tr>
<td>Artificial intelligence</td>
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<tr>
<td>Probabilistic programming****</td>
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<tr>
<td>Image processing</td>
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<tr>
<td>Supercomputing</td>
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<tr>
<td>Computer vision</td>
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<td></td>
</tr>
<tr>
<td>Controls***</td>
<td></td>
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</tr>
</tbody>
</table>

** Added in 2021
*** Added in 2022
**** Added in 2023
Professionals Are Nearly Half of Survey Respondents

Which of the following best describes you? Please select all that apply.

- Academic
- Professional
- Hobbyist****

**2019**
- Academic: 60%
- Professional: 61%
- Hobbyist**: 60%

**2020**
- Academic: 60%
- Professional: 56%
- Hobbyist**: 58%

**2021**
- Academic: 61%
- Professional: 47%
- Hobbyist**: 47%

**2022**
- Academic: 43%
- Professional: 43%
- Hobbyist**: 43%

**2023**
- Academic: 43%
- Professional: 47%
- Hobbyist**: 47%

****Added in 2023
Among Academics, Most Respondents Are Researchers, Graduate or Postgraduate Students or Researchers

**Among Academics: Are you a(n):**

- Graduate or postgraduate student or researcher: 69% (2020), 56% (2021), 52% (2023)
- Researcher**: 43% (2020)
- Faculty**: 19% (2020), 23% (2021), 3% (2023)
- Postdoctoral researcher or fellow**: 16% (2020)
- Undergraduate student or researcher: 11% (2020), 12% (2021), 3% (2023)
- Research software engineer: 10% (2020), 7% (2021), 8% (2023)
- Instructor: 34% (2020), 20% (2021), 6% (2023)
- Research software engineer: 34% (2023)

** Added in 2021
*** Added in 2022
**** Added in 2023
Among Professionals, Most Respondents Are Engineers or Developers

**AMONG PROFESSIONALS: Are you a(n):**

- Engineer, developer: 77% (2019), 71% (2020), 70% (2021), 61% (2022), 4% (2023)
- Researcher: 45% (2019), 44% (2020), 41% (2021), 48% (2022), 5% (2023)
- Analyst: 24% (2019), 22% (2020), 17% (2021), 21% (2022), 6% (2023)
- Manager: 11% (2019), 13% (2020), 12% (2021), 15% (2022), 6% (2023)
- Product manager: 4% (2019), 5% (2020), 6% (2021), 5% (2022), 6% (2023)
Among Professionals, the Most Common Industries Include Software, IT and Engineering

AMONG PROFESSIONALS: What is the primary industry in which you work?

- **Software, IT**: 39% (2023), 39% (2022), 42% (2021)
- **Engineering**: 23% (2023), 23% (2022), 29% (2021)
- **Finance**: 11% (2023), 12% (2022), 13% (2021)
- **Life sciences, health care, pharmaceuticals**: 1% (2023), 1% (2022), 1% (2021)
- **Consulting**: 7% (2023), 8% (2022), 9% (2021)
- **Energy**: 7% (2023), 8% (2022), 9% (2021)
- **Government**: 5% (2023), 6% (2022), 7% (2021)
- **Aerospace, aviation**: 5% (2023), 6% (2022), 7% (2021)
- **Manufacturing**: 3% (2023), 4% (2022), 5% (2021)
- **Telecommunications**: 3% (2023), 4% (2022), 4% (2021)
- **Semiconductors**: 3% (2023), 3% (2022), 3% (2021)
- **Automation**: 2% (2023), 3% (2022), 5% (2021)
- **Transport**: 2% (2023), 3% (2022), 4% (2021)
- **Automotive**: 2% (2023), 2% (2022), 2% (2021)
- **Logistics**: 1% (2023), 2% (2022), 2% (2021)
- **Ecommerce**: 1% (2023), 2% (2022), 2% (2021)
- **Retail**: 1% (2023), 2% (2022), 2% (2021)
- **Agriculture**: 1% (2023), 2% (2022), 2% (2021)

** Added in 2021
**** Added in 2023
***** Pharmaceuticals merged with life sciences/health care in 2023
Among Academics, the Most Common Fields Are Computer Science, Mathematics, Physics and Biology

**AMONG ACADEMICS: What is your primary field of study or research?**

<table>
<thead>
<tr>
<th>Field</th>
<th>2023</th>
<th>2022</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer science</td>
<td>29%</td>
<td>30%</td>
<td>25%</td>
</tr>
<tr>
<td>Mathematics</td>
<td>25%</td>
<td>26%</td>
<td>25%</td>
</tr>
<tr>
<td>Physics</td>
<td>22%</td>
<td>28%</td>
<td>25%</td>
</tr>
<tr>
<td>Biology, life sciences</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Statistics****</td>
<td>15%</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>Electrical engineering</td>
<td>8%</td>
<td>10%</td>
<td>6%</td>
</tr>
<tr>
<td>Mechanical engineering</td>
<td>7%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>Economics</td>
<td>7%</td>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>Geosciences</td>
<td>7%</td>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>Astronomy</td>
<td>6%</td>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>Climate science</td>
<td>4%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Chemical engineering</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
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<tr>
<td>Civil engineering</td>
<td>3%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Medicine, pharmaceuticals</td>
<td>3%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Aerospace engineering</td>
<td>4%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Industrial engineering****</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Finance</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Education</td>
<td>3%</td>
<td>3%</td>
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</tr>
<tr>
<td>Humanities</td>
<td>3%</td>
<td>3%</td>
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</tr>
<tr>
<td>Business</td>
<td>2%</td>
<td>3%</td>
<td>3%</td>
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<tr>
<td>Sociology</td>
<td>2%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Political science</td>
<td>1%</td>
<td>1%</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Notes:*
- **Statistics****: Includes Data Science and Information Science.
- **Industrial engineering****: Includes Manufacturing and Mechanical Engineering.
- **Computer science**: Includes Artificial Intelligence, Data Science, and Robotics.
- **Physics**: Includes Astronomy, Geophysics, and Quantum Physics.
- **Biology, life sciences**: Includes Evolution, Genetics, and Neuroscience.
- **Economics**: Includes Microeconomics, Macroeconomics, and Finance.
- **Geosciences**: Includes Meteorology, Oceanography, and Environmental Science.
- **Chemistry**: Includes Organic Chemistry, Inorganic Chemistry, and Physical Chemistry.
- **Climate science**: Includes Climate Modeling, Atmospheric Science, and Environmental Science.
- **Chemical engineering**: Includes Materials Science, Environmental Engineering.
- **Civil engineering**: Includes Structural Engineering, Geotechnical Engineering.
- **Medicine, pharmaceuticals**: Includes Biostatistics, Molecular Medicine.
- **Aerospace engineering**: Includes Aeronautics, Space Science.
- **Industrial engineering****: Includes Manufacturing, Materials Science.
- **Finance**: Includes Financial Engineering, Risk Management.
- **Education**: Includes Educational Psychology, Educational Research.
- **Humanities**: Includes History, Philosophy, Sociology.
- **Business**: Includes Management, Entrepreneurship.
- **Sociology**: Includes Social Psychology, Social Work.
- **Political science**: Includes Political Theory, International Relations.

Data source: **JuliaHub**
Julia Users Would Be More Likely to Recommend Julia if Startup Time Is Reduced

What type of improvements to Julia would make you more likely to recommend Julia to other people?

- Reduced startup time (time to first X): 38%
- More machine learning functionality: 20%
- More statistical functionality: 15%
- More web development functionality: 9%
- No improvements are necessary: 5%
- There is nothing that would make me likely to recommend Julia to other people: 1%
Most Julia Users & Developers Have 15 Years Coding Experience or Less, But the Number With 11+ Years of Experience Is Growing

How many years of coding experience do you have?

<table>
<thead>
<tr>
<th>Experience Range</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>23%</td>
<td>20%</td>
<td>17%</td>
</tr>
<tr>
<td>6-10</td>
<td>27%</td>
<td>27%</td>
<td>25%</td>
</tr>
<tr>
<td>11-15</td>
<td>15%</td>
<td>17%</td>
<td>18%</td>
</tr>
<tr>
<td>16-20</td>
<td>9%</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>21-25</td>
<td>7%</td>
<td>7%</td>
<td>8%</td>
</tr>
<tr>
<td>26-30</td>
<td>5%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>30+</td>
<td>12%</td>
<td>14%</td>
<td>17%</td>
</tr>
</tbody>
</table>
Most Julia Users and Developers Are Age 23-40
The Number of Julia Users and Developers Age 36+ Is Growing

What is your age?

- 15-22: 8% (Julia), 7% (JuliaHub)
- 23-29: 25% (Julia), 25% (JuliaHub)
- 30-35: 20% (Julia), 20% (JuliaHub)
- 36-40: 13% (Julia), 12% (JuliaHub)
- 41-45: 9% (Julia), 9% (JuliaHub)
- 46-50: 7% (Julia), 6% (JuliaHub)
- 51-55: 7% (Julia), 7% (JuliaHub)
- 56-60: 5% (Julia), 4% (JuliaHub)
- 61-65: 3% (Julia), 3% (JuliaHub)
- 66-70: 2% (Julia), 2% (JuliaHub)
- 70+: 1% (Julia), 1% (JuliaHub)
Respondents Live or Work in Over 75 Countries and Regions
Germany and France Show Most Growth

What is the country or region where you currently live or work?

Respondents also live or work in: Denmark, Austria, Mexico, Russia, Belgium, Poland, Norway, New Zealand, Czech Republic, South Africa, Romania, Colombia, Israel, Portugal, Turkey, Singapore, South Korea, Hungary, Argentina, Chile, Iran, Finland, Indonesia, Greece, Hong Kong, Nigeria, Ecuador, Slovenia, Estonia, Thailand, Serbia, Bolivia, Kenya, Ireland, Namibia, Comoros, Armenia, Antigua and Barbuda, Iraq, Ghana, Philippines, Taiwan, Costa Rica, Ukraine, Egypt, Venezuela, Afghanistan, Brunei, Algeria, Montenegro, Saudi Arabia, Georgia, Senegal, Uganda, Iceland, United Arab Emirates, Kuwait, Croatia, Luxembourg, Vietnam, Macao, Malaysia.
Respondents Come from 82 Countries and Regions
Germany and France Show Most Growth

What is the country or region where you are originally from?

Respondents also come from:
Respondents Are Fluent in 60 Languages

In what language(s) are you fluent?

Respondents are also fluent in: Afrikaans, American Sign Language, Arabic, Bengali, Bosnian, Bulgarian, Croatian, Czech, Estonian, Farsi, Finnish, Georgian, Greek, Gujarati, Hungarian, Icelandic, Igbo, Indonesian, Kannada, Kazakh, Korean, Lithuanian, Luxembourgish, Macedonian, Malay, Marathi, Malayalam, Norwegian, Oriya, Oromo, Polish, Punjabi, Romanian, Serbian, Slovakian, Slovenian, Swahili, Tagalog, Tamil, Telugu, Thai, Turkish, Ukrainian, Urdu, Vietnamese, Yoruba, Zulu
Most Respondents Are White or Asian

Which of the following best describes your race or ethnicity?

- White: 66% (2019), 60% (2020), 57% (2021), 57% (2022), 66% (2023)
- Asian: 23% (2019), 19% (2020), 15% (2021), 15% (2022), 23% (2023)
- Hispanic: 8% (2019), 8% (2020), 8% (2021), 8% (2022), 8% (2023)
- Middle Eastern: 2% (2019), 2% (2020), 2% (2021), 2% (2022), 2% (2023)
- Black: 2% (2019), 2% (2020), 2% (2021), 2% (2022), 2% (2023)
- Decline to answer: 7% (2019), 7% (2020), 7% (2021), 7% (2022), 7% (2023)

Other responses selected in 2023 include American Indian, Maori and Native Hawaiian or Pacific Islander.
90% Identify as Men, 2% Identify as Women, 1% as Non-Binary and 7% Decline to Answer
6% Identify as LGBTQIA+

Do you identify as LGBTQIA+?

- Yes: 4% (2019), 4% (2020), 5% (2021), 5% (2022), 6% (2023)
- No: 79% (2019), 81% (2020), 81% (2021), 83% (2022), 83% (2023)
- Decline to answer: 17% (2019), 15% (2020), 14% (2021), 10% (2022), 11% (2023)
21% Identify as Underrepresented in Science or Computing

Do you identify as underrepresented in science or computing because of your:

- [ ] Age
- [ ] Race, ethnicity or natural origin
- [ ] Education level
- [ ] Parents’ education level
- [ ] Income or socioeconomic status
- [ ] Language (2023: or language proficiency)**
- [ ] Gender
- [ ] Political or ideological beliefs***
- [ ] Sexual orientation**
- [ ] Religion
- [ ] Disability
- [ ] Gender identity (2019-2020: Sexual identity)
- [ ] I do not identify as underrepresented in science or computing
- [ ] Decline to answer

** Added in 2021
*** Added in 2022
Contact

Andrew.Claster@JuliaHub.com