



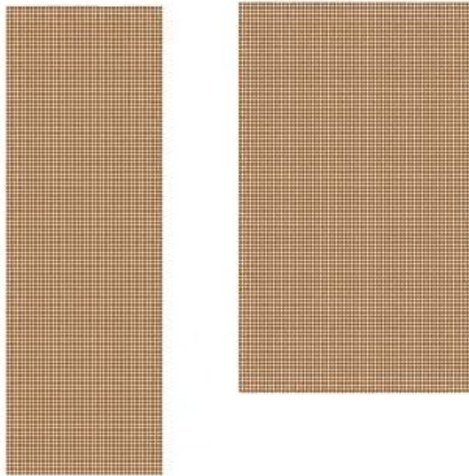
# 太极图形课

---

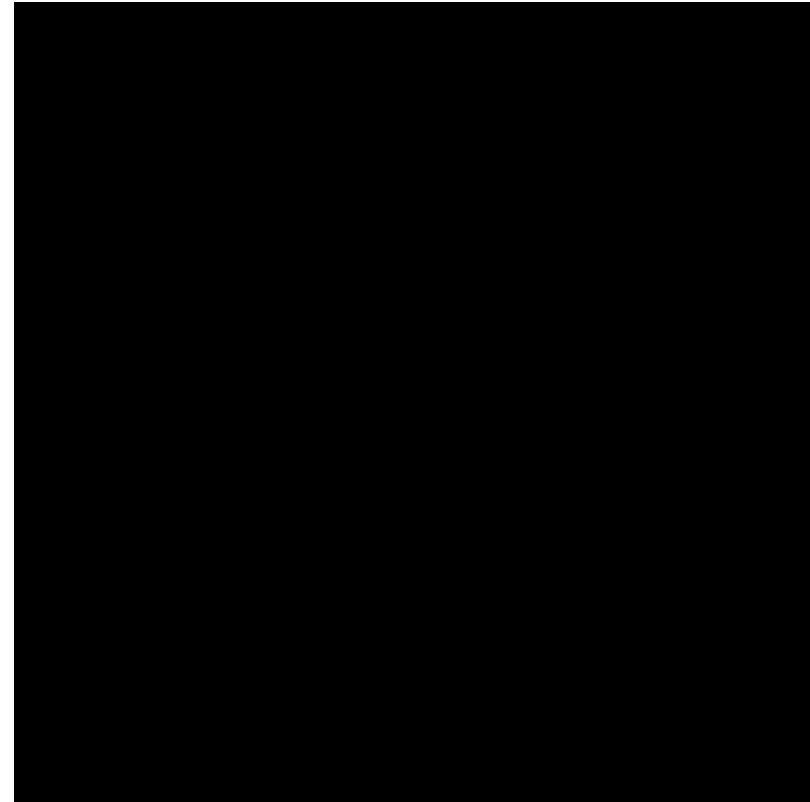
第12讲 Prologue



# Fluid sim: recap

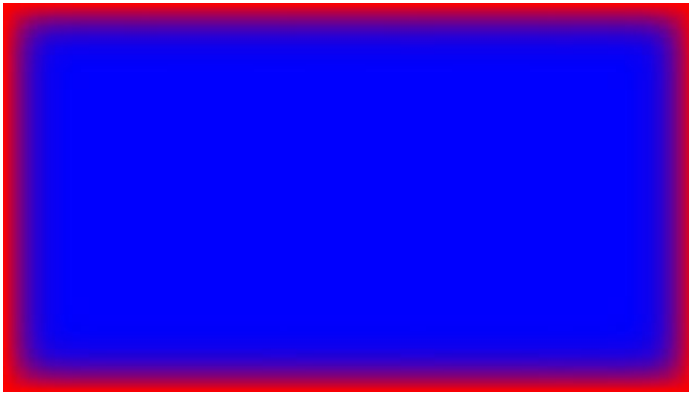


Lagrangian view

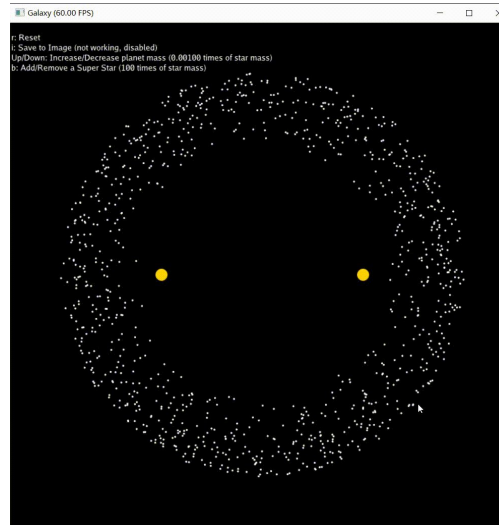


Eulerian view

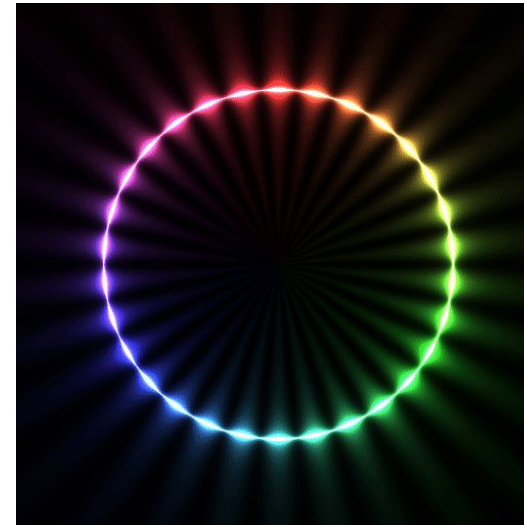
# Excellent homework assignments



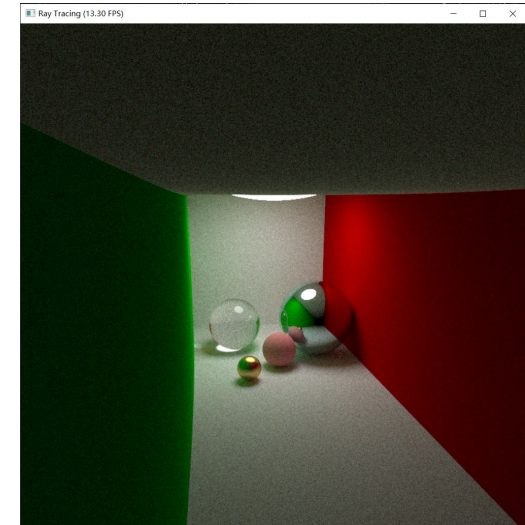
[@bjmiao]



[@bjmiao]

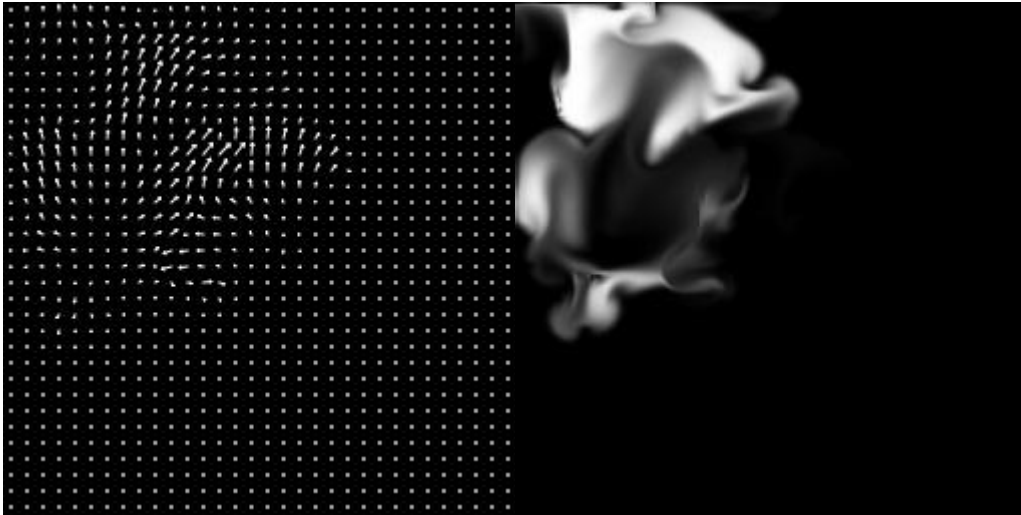


[@bjmiao]

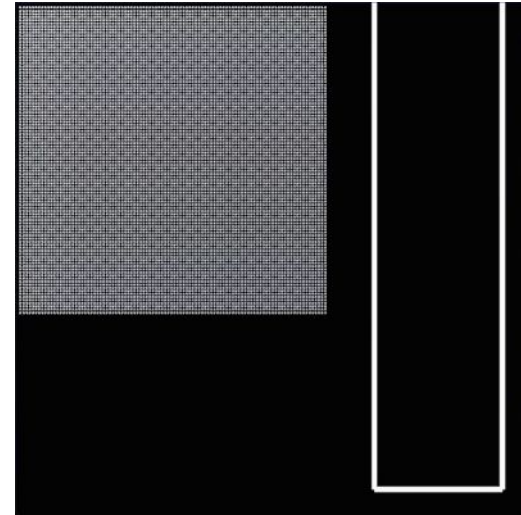


[@bjmiao]

# Excellent homework assignments



[@0xrabbyte]



[@cflw]

# Final project

- 死线: 2022年1月3日
- 要求:
  - 使用[作业模板](#)
  - 需要有设计文档, 如果有参照代码也需要标明
- 题材:
  - 任何使用Taichi完成的内容(图形学更佳)
  - 可以参考每节图形课后给出的大作业选题灵感 [参考第[07](#),[09](#),[10](#),[11](#)讲](链接精准空降)
  - 鼓励实现任意图形学论文/图形学课程内容
  - 可以在小作业的基础上完成大作业 (Homework Promotion!)
- 形式:
  - 使用 GitHub/Gitee提交并邀请[tgc01@taichi.graphics](mailto:tgc01@taichi.graphics)加入你的代码仓
  - 允许三人以下合作, 记得管理多人合作的 git commits
- 奖励:
  - 太极图形课第一季结业证书一份+神秘Taichi小礼物一份

# Next week: 太极图形课第一季线上见面会

- 时间: 2021年12月21日晚7点
- 地点: 线上直播
- 内容(暂定):
  - 揭秘图形课的制作: 我们一起走过的时光
  - 承前启后: 关于第二季.....
  - 当助教是一种什么样的体验? (助教指南)
  - 图形课的片头是怎样炼成的? @ [victoriacity74](#)
  - 天添老师表演节目
  - 在线答疑
  - 抽奖+谢幕+幕后花絮
  - 圆桌讨论(闭门会议)



# 太极图形课

---

第12讲 如何成为Taichi的贡献者



# About Me

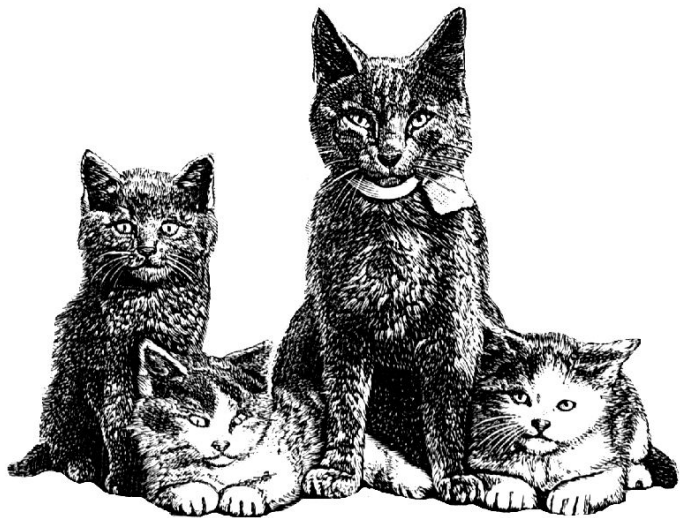


- Ailing Zhang 张爱玲
  - Compiler Architect @ Taichi Graphics
  - THU→UIUC→Facebook(PyTorch)→Taichi
- 手把手教你向Taichi仓库贡献代码, 成为Taichi开发者



# Outline

- **Taichi编程语言技术栈**
- 如何参与Taichi开发
- 提升Taichi开源社区体验



# Taichi语言

从入门到提交bug report

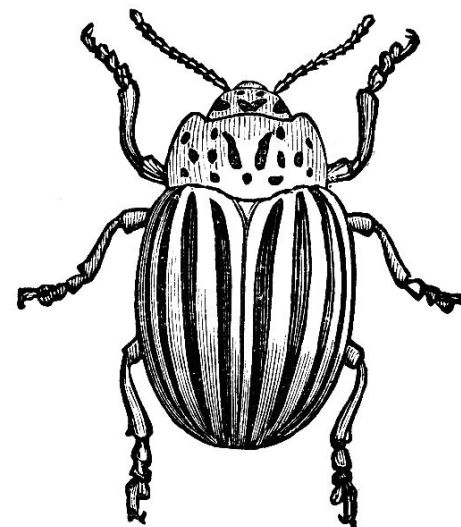
O'RELLY

Taichi Graphics



# Taichi语言

从 bug report 到 bug fix

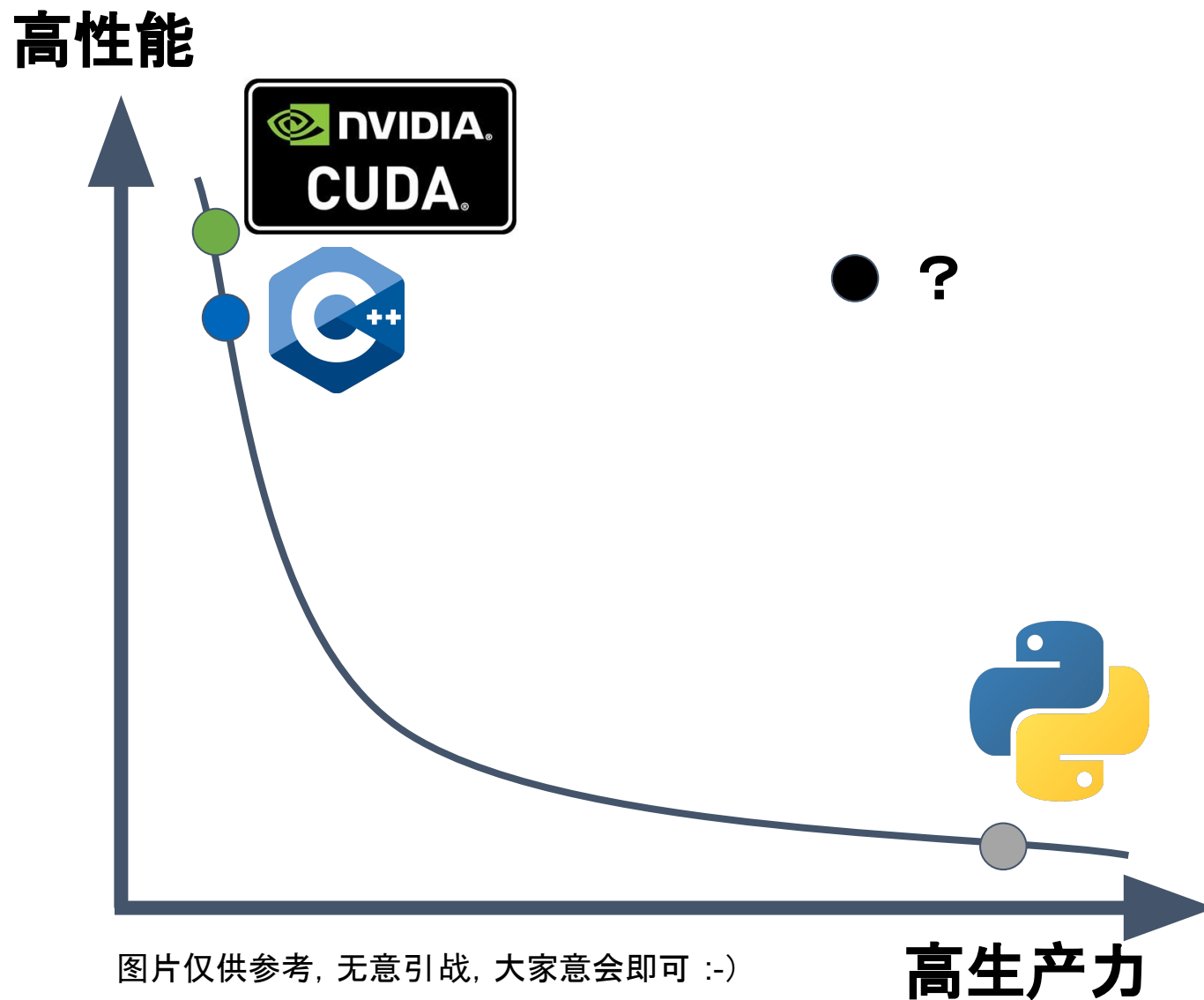


O'RELLY

Taichi Graphics

# 性能与生产力的取舍

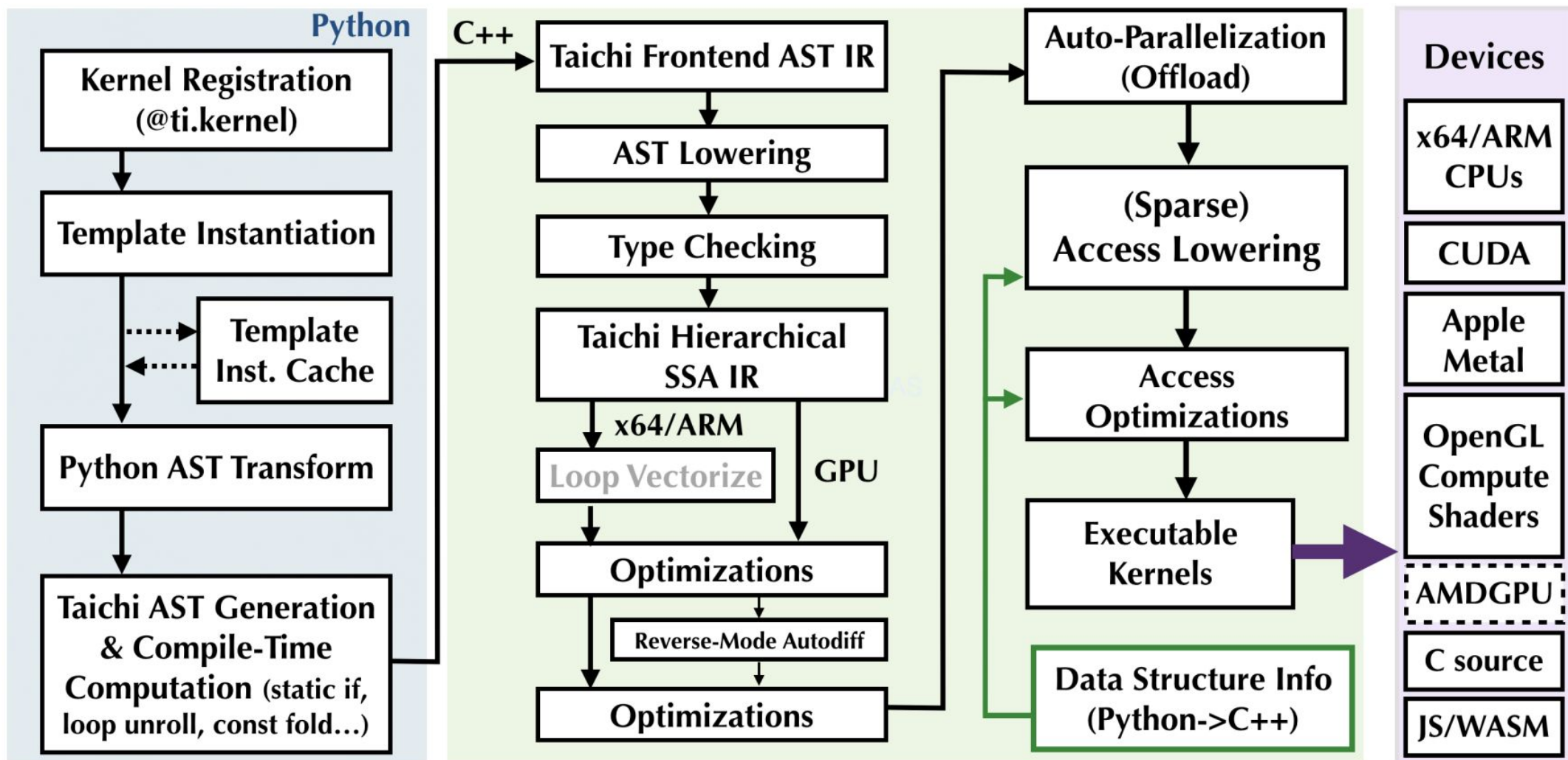
- 如何给编程语言画像？
  - 跑的快不快？（性能）
  - 容易不容易用？（生产力）
  - 能在哪些地方跑？（可移植性）
  - ...
- 鱼与熊掌不可兼得
  - 如果一定要兼得呢？



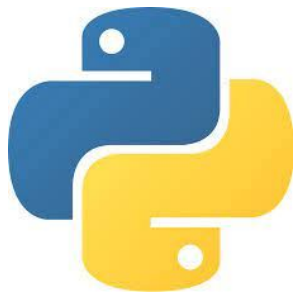
# 兼得高性能和高生产力:Taichi是什么？

- 一种嵌入在 Python 中的**并行**编程语言
  - 通过即时编译的方式将Python编译成高性能的并行机器代码并执行
  - 让每个 Python 程序员都可以**轻松地实现高性能**计算，特别是数值计算
- **定位**:Parallel programming for everyone 每个人的并行编程语言
- 虽然语言的前端在 Python 中，但是拥有**独立的中间表示、编译优化、和后端代码生成**

# ti.kernel的一生














# Taichi的技术栈



Python/C++

Linux/MacOS/Windows

- 编译器
- 并行计算
- 自动微分
- 稀疏数据结构
- 内存排布优化
- ...

# Taichi生态的技术栈



GitHub Actions



[taichi-api-docstring](#)

Navigation

Quick search

## Index

[A](#) | [B](#) | [C](#) | [D](#) | [E](#) | [F](#) | [G](#) | [H](#) | [I](#) | [K](#) | [L](#) | [Y](#) | [Z](#)

### A

[abs\(\)](#) ([in module taichi.lang](#)).  
([in module taichi.lang.ops](#)).  
[acos\(\)](#) ([in module taichi.lang](#)).  
([in module taichi.lang.ops](#)).  
[add\(\)](#) ([in module taichi.lang](#)).  
([in module taichi.lang.ops](#)).

# Outline

- Taichi编程语言技术栈
- **如何参与Taichi开发**
- 提升Taichi开源社区体验



# 谁在开发 Taichi?

taichi-dev / taichi ✓

Watch

★ Unstar

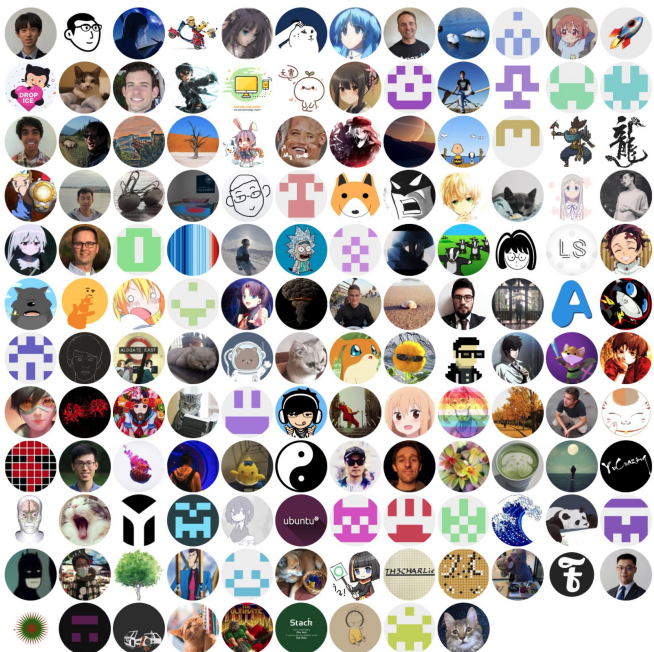
17.6k

Fork

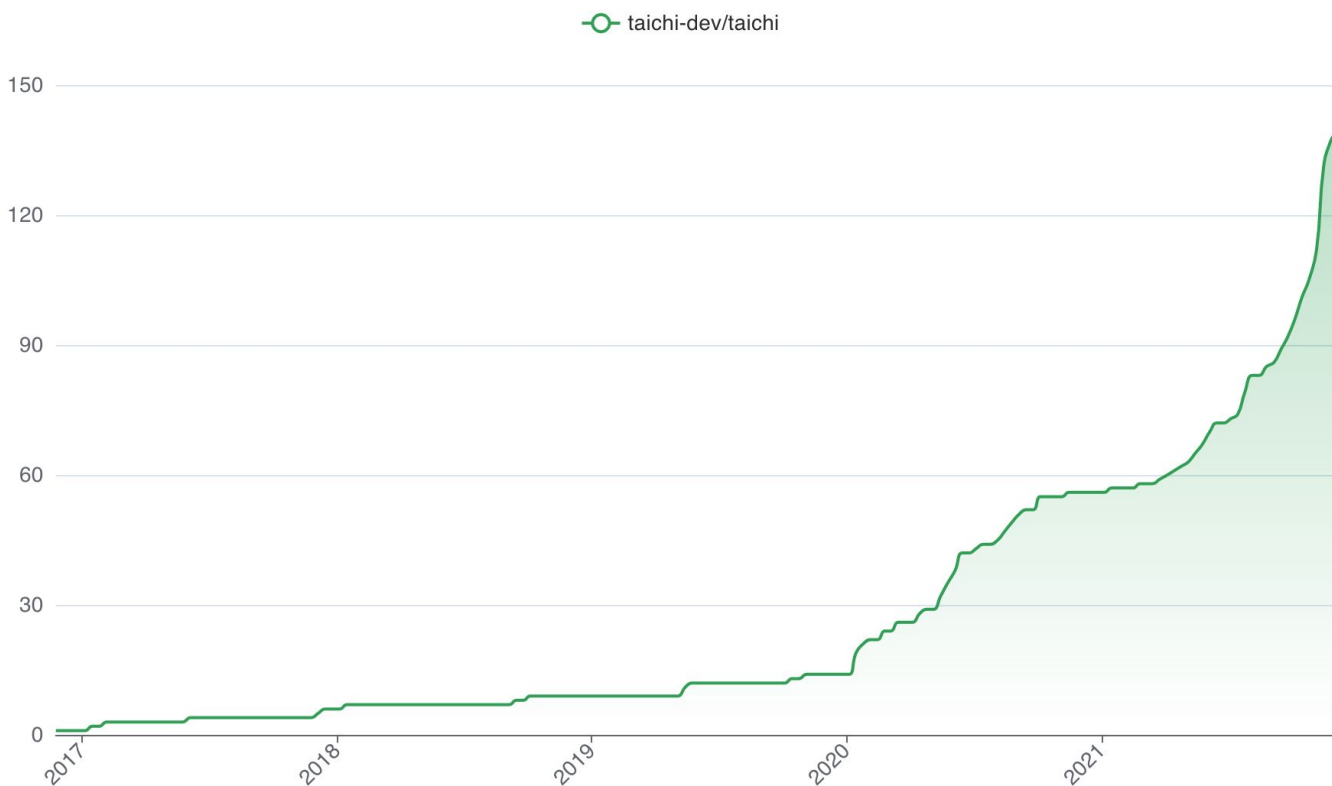
1.8k

- 太极图形团队
- 太极开发者社区

Contributors



Contributor Over Time



# 为什么开源？


- 开源是Taichi的基因
- 用户需求指导开发
- 集思广益, 希望更多的小伙伴一起参与构建Taichi语言


# 贡献者


- 包括但不限于Taichi语言的开发者：
  - Bug fixes
  - New features
  - Perf improvements
- Taichi生态
  - Continuous Integration
  - Build system & releases
  - Tests
- 社区
  - Bug reports
  - Feature requests
  - Doc improvements
  - Forum
- 内容
  - Blog posts & tutorials
  - Examples


# 寻找贡献机会

☐ ✓ 25 Open 40 Closed

☐  Remove `print_preprocessed` which is no longer used.  
#3748 opened 2 days ago by [ailzhang](#)  
good first issue refactor welcome contribution


☐  Remove deprecated APIs  
#3590 opened 18 days ago by [ailzhang](#)  
enhancement good first issue welcome contribution


☐  [GGUI] Fix crash when certain keys are pressed.  
#3254 opened on Oct 23 by [AmesingFlank](#)  
good first issue gui potential bug


☐  Make arch part of the test name  
#3128 opened on Oct 9 by [k-ye](#)  
ci feature request good first issue medium welcome contribution


[Good first issues](#)


☐ ✓ 74 Open 105 Closed


☐  Reduce windows build script to minimal dependencies  
#3754 opened 2 days ago by [ailzhang](#)  
build RFC welcome contribution

☐  Enhance the default scheduling mechanism of the CPU backend  
#3750 opened 2 days ago by [strongoier](#)  
advanced optimization discussion feature request welcome contribution

☐  Remove `print_preprocessed` which is no longer used.  
#3748 opened 2 days ago by [ailzhang](#)  
good first issue refactor welcome contribution

☐  [refactor] Remove the necessity to use shared Device pointer  
#3624 opened 15 days ago by [k-ye](#)  
c++ discussion enhancement welcome contribution

☐  Remove deprecated APIs  
#3590 opened 18 days ago by [ailzhang](#)  
enhancement good first issue welcome contribution

☐  Run all ti examples before a release  
#3580 opened 19 days ago by [ailzhang](#)  
potential bug welcome contribution

[Welcome contribution](#)

# 认领issue

izackwu 8 days ago · edited ▼

Hi, I'd like to take this issue. Please assign it to me :)

k-ye 8 days ago

Member



Tip

Thanks @izackwu for the help! It's yours now. We may need to go through known significant projects like [taichi-dev/taichi\\_elements](#) and [taichi-dev/difftaichi](#) to make sure they no longer use the legacy APIs. cc: @erizmr @strongoier

izackwu 2 days ago

Actually, there're even more APIs to deprecate in the codebase, like: (note th






```
88:normalized = deprecated('ti.normalized(a)',  
601:.....f'"use_unified_memory" is a deprecated option, as  
801:determinant = deprecated('ti.determinant(a)',  
803:tr = deprecated('ti.tr(a)', 'a.trace()')(Matrix.trace)
```

在Github上公开的讨论便于以后看到issue的读者了解上下文

# Demo



# Taichi 代码库结构

 .github	CI / release	[ci] Update performance monitoring ( <a href="#">#3741</a> )
 .travis		Taichi build on macOS with Python 3.6 to Python 3.8 covered <a href="#">#409</a> (...)
 benchmarks		[benchmark] Store the benchmark results as json files ( <a href="#">#3294</a> )
 ci		[ci] Auto generate manylinux dockerfile ( <a href="#">#3699</a> )
 cmake	Build system	[Android] Add initial support of the platform ( <a href="#">#3755</a> )
 conda		[Misc] Fix the path in conda_env.yaml ( <a href="#">#2895</a> )
 cpp_examples		[refactor] Separate Cpp examples into different files ( <a href="#">#3728</a> )
 docs/lang	Documentation	[Android] Add initial support of the platform ( <a href="#">#3755</a> )
 external		[Mesh] [opt] Support mesh-for for multi-CPUs & demote atomic stm...
 misc		[Android] Add initial support of the platform ( <a href="#">#3755</a> )
 python	python frontend	[Lang] Enforce members of a matrix field to have same shape ( <a href="#">#3761</a> )
 scripts		[Lang] Fix pylint rule W1309 (f-string-without-interpolation) ( <a href="#">#3757</a> )
 taichi	C++ libtaichi_core.so	[bug] Enable int32 atomic ops for opengl backend. ( <a href="#">#3760</a> )
 tests	Tests	[Lang] Enforce members of a matrix field to have same shape ( <a href="#">#3761</a> )



# Demo

-



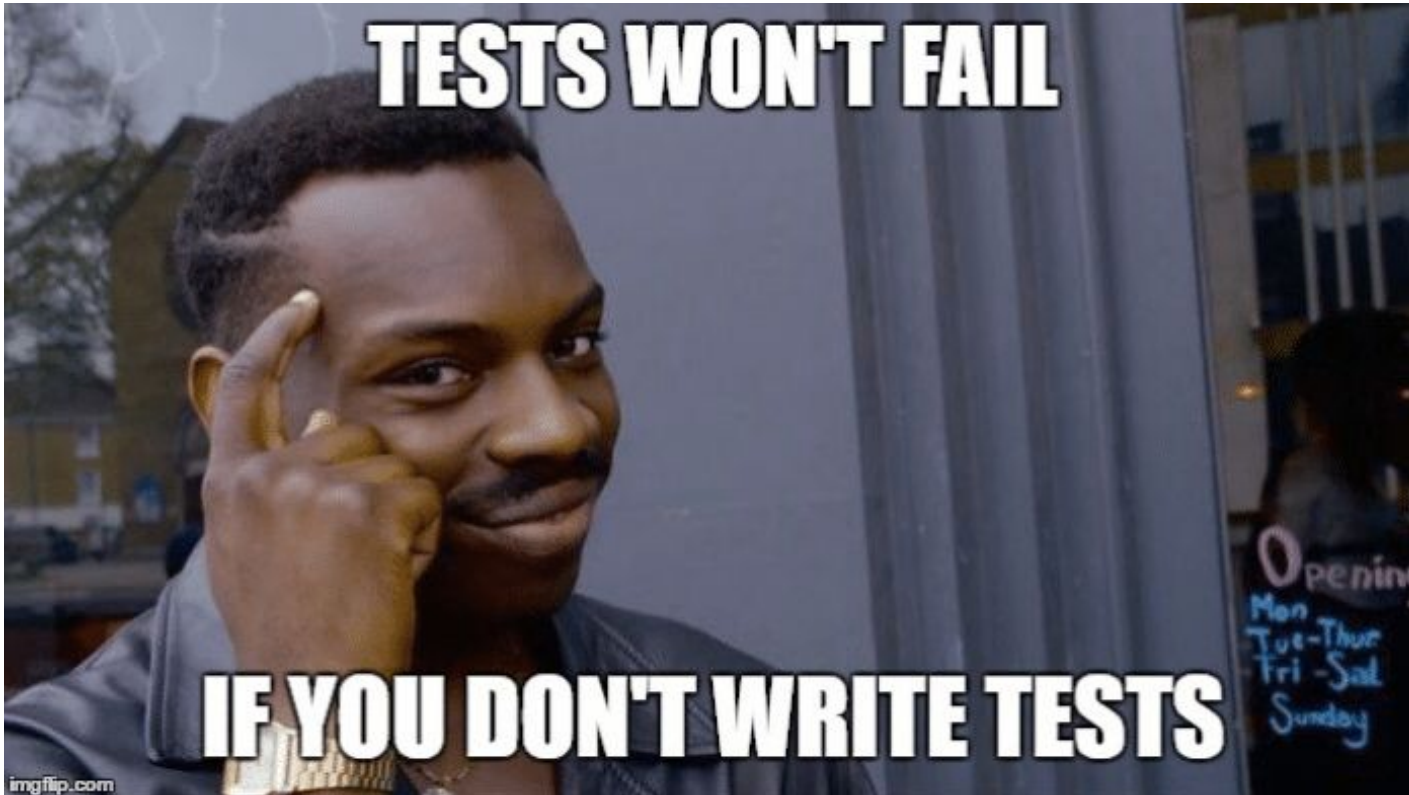


# Debugging

- `pdb` & `gdb` are your good friends
  - To use `gdb`: `DEBUG=1 python setup.py develop`
- `print` is your best friend

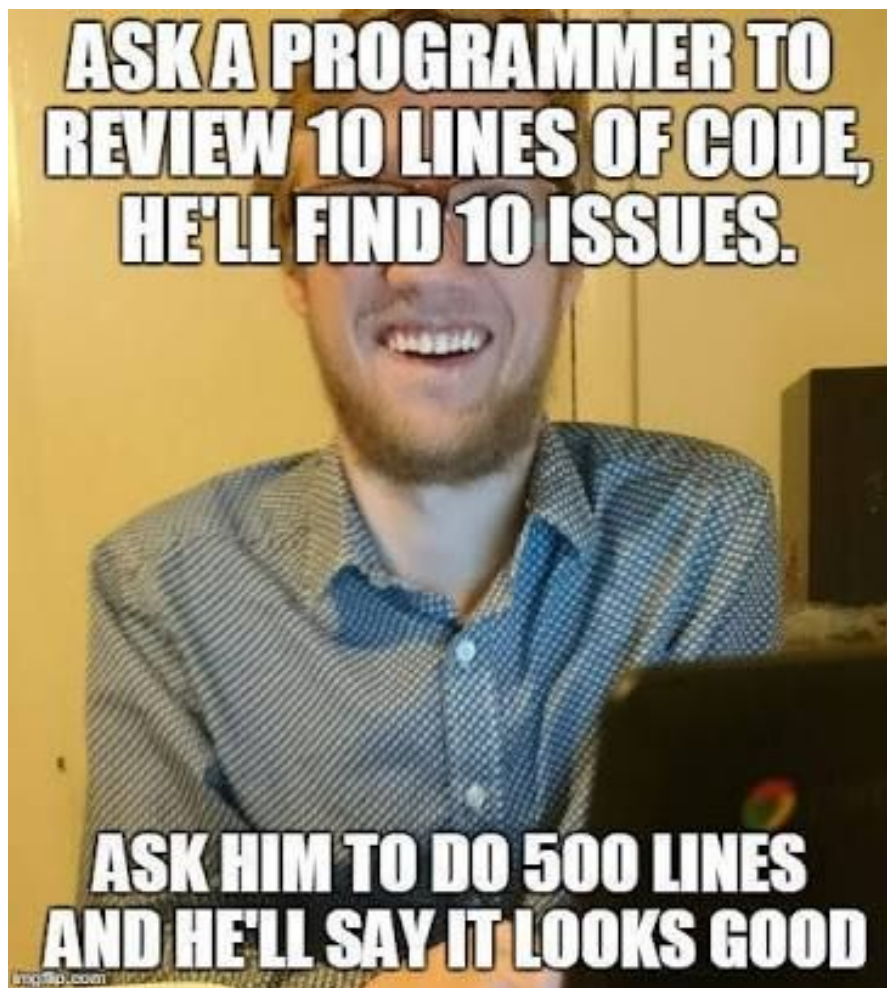
<https://docs.taichi.graphics/lang/articles/contribution/utilities#debug-taichi-program-using-gdb>

# Dev Tips



```
34 tests/python/test_materialize_check.py
... @@ -0,0 +1,34 @@
1  import pytest
2
3  import taichi as ti
4
5
6  @ti.test()
7  def test_check_field_not_placed():
8      a = ti.field(ti.i32)
9
10     @ti.kernel
11     def foo():
12         pass
13
14     with pytest.raises(RuntimeError,
15                         match=r"These field\(s\) are not placed.*"):
16         foo()
17
```

# Dev Tips



PR一般不超过两百行  
超过的话很可能是可以拆成多个PR的

+400 -85

0 / 11 files viewed

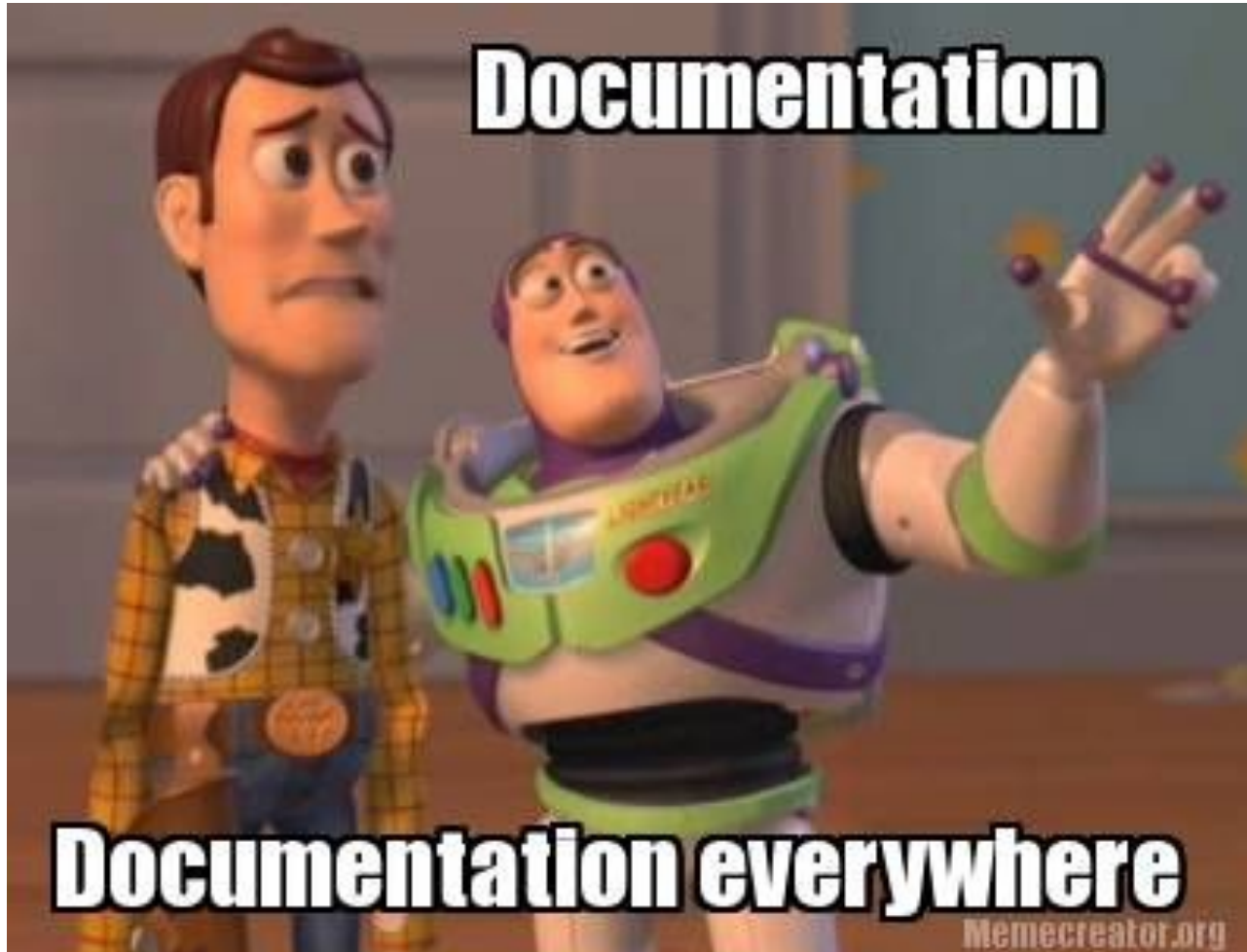


Review changes



救救孩子吧

# Dev Tips



## [GUI] Fix gui.text crash bug #3770

Merged by strongoier · taichi-dev/taichi on Dec 9 · 1 hour ago

Conversation 4

FantasyVR 2 · bug

Related issue = #3769

bugfix: GUI.text crash

Describe the bug When I run the [taichi course code](#) using Taichi 0.8.7, AttributeError...

## [refactor] Let build\_xxx in ASTTransformer return node.ptr instead of node #3695

Merged by strongoier · taichi-dev:master ← lin-hitonami:build\_ptr · 5 days ago

Conversation 3 · Commits 8 · Checks 14 · Files changed 4

lin-hitonami 9 days ago · edited

Member · Tip

Related issue = #3694

This is a necessary refactoring to resolve #3694. Since we do not modify the AST anymore after the refactoring, we do not need to assign the new node back to the old node in the AST. So, we can simplify the programming by returning node.ptr in build\_xxx of expression nodes and None for build\_xxx of statement nodes. In this way, many codes like `a = build_stmt(ctx, b).ptr` can be simplified to `a = build_stmt(ctx, b)`.

ASTTransformerCheck will be removed in the near future, the modification to it is just a workaround to pass the tests of real functions with multiple returns.

Reviewers – review

- strongoier
- k-ye
- ailzhang

Assignees – assign

Labels



Projects



# Dev Tips



```
python misc/code_format.py  
pylint python/taichi/ --disable=all --enable=$(python scripts/generate_pylint_tags.py)
```

✓		Build and Test / Check Code Format (pull_request)	Successful in 35s	Required	<a href="#">Details</a>
✓		Build and Test / Check Static Analyzer (pull_request)	Successful in 9m		<a href="#">Details</a>

# Dev Tips



```
misc/demo_warning.py
12
13
14 func()
5 ti.dot(x, x)
```

**ailzhang** 5 days ago Member 😊 ✎ ⚠️ Tip ...  
Looks like this file was used to demo the deprecated warning message. Shall we remove it then? ;)

**izackwu** 5 days ago • edited Contributor Author 😊 ✎ ⚠️ Tip ...  
Actually, as I have removed the deprecated API ( `transposed` ), this demo would break. So I just picked another deprecated API (yes, there're still some more APIs to deprecate in the codebase and they are not included in this PR) for the demo.

😊 👍 1

**ailzhang** 5 days ago Member 😊 ✎ ⚠️ Tip ...  
Aha I see, makes sense! Thanks!

😊 ❤️ 1

**strongoier** 5 days ago Member 😊 ✎ ⚠️ Tip ...  
**@ailzhang** Do we need another issue for other deprecated APIs not covered here?

😊 👍 1

**izackwu** 4 days ago Contributor Author 😊 ✎ ⚠️ Tip ...  
glad to help if we're going to remove all remaining deprecated APIs ;)

😊 👍 1

**ailzhang** 4 days ago Member 😊 ✎ ⚠️ Tip ...  
**@izackwu** awesome thanks! Would you mind opening an issue as well? Thanks a lot!

# 你能获得什么？

- 积累大型项目的开发经验
- 在交流讨论中学习更好的design
- 找到有共同兴趣的合作者

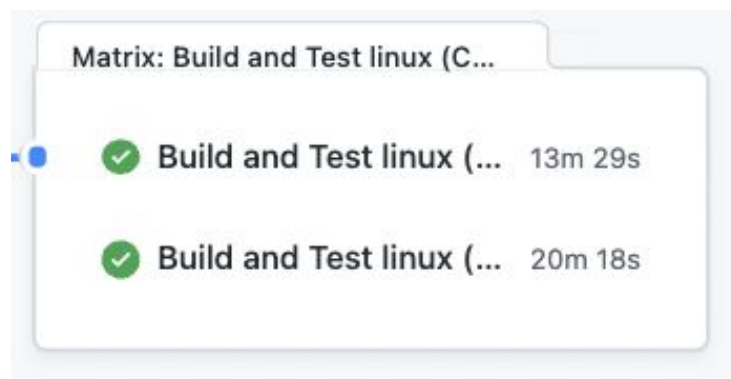
# Outline

- Taichi编程语言技术栈
- 如何参与Taichi开发
- **提升Taichi开源社区体验**



# 提升社区体验

- 加速Continuous Integration
- 完善开发者[安装Taichi指南](#)
- 完善开发者[贡献指南](#)
- 积极响应 github / forum 的问题



# 提升社区透明度

8 Open ✓ 5 Closed Sort ▾	
<b>Docs</b> 🕒 Updated on Nov 10	Docs related issues ...
<b>Improve quality of the codebase</b> 🕒 Updated 8 days ago	The purpose of this project is to continuously improve the quality of our codebase, including CI/CD, refactors, code styles, etc. ...
<b>GGUI</b> 🕒 Updated 26 days ago	This project covers many aspects of the GGUI (GPU-based GUI) system, including new backend, GUI API migration, etc ...
<b>Backends Performance</b> 🕒 Updated 21 days ago	We are setting up a continuous performance benchmark/regression framework and are planning to improve the kernel performance of various backends. ...
<b>Language Features &amp; Compiler Frontend</b> 🕒 Updated 2 days ago	This project includes adding new language features as well as improving the compiler frontend (the whole process from user Python code to CHI IR). Current focus: ... <ul style="list-style-type: none"><li>• Type system</li><li>• User error reporting</li><li>• Python AST transformation</li></ul>
<b>AOT</b> 🕒 Updated 8 days ago	This project is to support the ahead-of-time (AOT) compilation mode in Taichi, so that the compiled kernels can be used outside the Python environment. We plan to first support AOT for the non-LLVM backends, due to its simplicity (no sparse data structure) and wide range of applicability. ...
<b>Unified Device API</b> 🕒 Updated 10 days ago	Unified Device API is an ongoing effort to unify the runtime implementation of all the Taichi backends. ... Expected outcome from this project: <ul style="list-style-type: none"><li>• Maintainability: a unified abstraction to describe all the components: buffers, textures, memory allocators, executors, ...</li><li>• AOT (ahead of time)</li></ul>
<b>CI/CD containerization</b> 🕒 Updated 11 days ago	By containerizing Taichi's CI/CD pipeline, we can obtain the maximum level of isolation and bug reproducibility. ...

<https://github.com/taichi-dev/taichi/projects>

<input type="checkbox"/>	<b>[RFC] Cross compile taichi_core.so to other targets</b> #3679 opened 9 days ago by <a href="#">ailzhang</a> discussion RFC
<input type="checkbox"/>	<b>[RFC] Taichi's Ahead of Time (AOT) Module</b> #3642 opened 11 days ago by <a href="#">k-ye</a> 3 of 11 tasks discussion feature request RFC
<input type="checkbox"/>	<b>[RFC] Caching memory allocator for ndarray</b> #3634 opened 12 days ago by <a href="#">qiao-bo</a> cuda feature request RFC

<https://github.com/taichi-dev/taichi/labels/RFC>

# 开展社区活动

- 目的鼓励更多小伙伴加入
- 与太极开发团队交流

# 提供反馈

- Github issues: 公开且可搜索
- Slack
- Email: `community@taichi.graphics`

# Questions?

下次直播:12/21 <- 太极图形课线上见面会

直播回放:Bilibili 搜索「太极图形」

主页&课件:<https://github.com/taichiCourse01>

主页&课件(backup):<https://docs.taichi.graphics/tgc01>