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# ShortScience.org - Reproducing Intuition

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## Abstract

shortscience.org is a platform for post-publication discussion aiming to improving accessibility and reproducibility. Anyone can write summaries for research papers on the site. Interested readers can read these summaries to get multiple perspectives on the given paper, in addition to the author's, thus gaining better understanding. Many regular contributors are expert machine learning researchers, whose descriptions make papers, and therefore the field of research, more accessible for all. Here we present statistics from the last year of operation and results from a user survey. We conclude that the site is having a reasonable impact on machine learning. We find that users are typically enrolled in Masters or PhD program and are younger than 30. The project will continue efforts to increase community involvement.

## 1 Motivation

shortscience.org is a platform for post-publication discussion aiming to improving accessibility and reproducibility. Anyone can write summaries for research papers on the site. Interested readers can read these summaries to get multiple perspectives on the given paper, in addition to the author's, thus gaining better understanding. Many regular contributors are expert machine learning researchers, whose descriptions make papers, and therefore the field of research, more accessible for all.

Our goal is to increase the reproducibility of intuition and ideas that the authors and other readers have. Concepts should more easily be spread across the community without the need to be part of a conferences or large large research lab. We expect if ideas are easier to understand then results will be easier to reproduce. We explore these claims with data in §3.3.

Papers can be hard to understand, for a variety of reasons:

- There is a lot of jargon in papers, often making vanilla ideas sound new and sexy
- Writers may feel it is best to obscure some ideas of papers, so that obvious flaws in papers cannot be found
- Authors are the least objective of their own research, as they are encouraged to make the work seem as significant and important as possible for it to be accepted
- Some ideas are just very complex and could use multiple perspectives to get a more complete understanding
- Some readers do not have access to papers directly and rely on second hand knowledge.

The best way to understand the contributions of a paper is to ask multiple domain experts to explain. However, not everyone has access to an expert, let alone multiple. ShortScience.org provides a platform for experts and non-experts alike to share notes on papers. These notes are available to all, providing a variety of explanations to help everyone better understand.

Density estimation using Real NVP

Laurent Dinh and Jascha Sohl-Dickstein and Samy Bengio

arXiv e-Print archive - 2016 via arXiv

Keywords: cs.LG

arxiv.org

arxiv-sanity.com

scholar.google.com

Summaries/Notes 2

This paper presents a novel neural network approach (though see [here](#) for a discussion on prior work) to density estimation, with a focus on image modeling. At its core, it exploits the following property on the densities of random variables. Let  $x$  and  $z$  be two random variables of equal dimensionality such that  $x = g(z)$ , where  $g$  is some bijective and deterministic function (we'll note its inverse as  $f = g^{-1}$ ). Then the change of variable formula gives us this relationship between the densities of  $x$  and  $z$ :

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$$p_x(x) = p_z(z) \left| \det \left( \frac{\partial g(z)}{\partial z} \right) \right|^{-1}$$

Moreover, since the determinant of the Jacobian matrix of the inverse  $f$  of a function  $g$  is simply the inverse of the Jacobian of the function  $g$ , we can also write:

$$p_x(x) = p_z(f(x)) \left| \det \left( \frac{\partial f(x)}{\partial x} \right) \right|$$

where we've replaced  $z$  by its deterministically inferred value  $f(x)$  from  $x$ .

So, the core of the proposed model is in proposing a design for bijective functions  $g$  (actually, they design its inverse  $f$ , from which  $g$  can be derived by inversion), that have the properties of being easily invertible and having an easy-to-compute determinant of Jacobian. Specifically, the authors propose to construct  $f$  from various modules that all preserve these properties and allows to

Figure 1: Example summary available on [shortscience.org](#). Shown in the figure is the paper title box which contains information about each paper such as venue, abstract, and useful links followed by a summary box which contains author, voting, view-source and the summary which can be formatted in Markdown and contain  $\text{\LaTeX}$ Math, Images, and Videos.

Where other discussion platforms on the internet have a broad focus, we have a narrow focus to each specific publication, leaving broad topics to other platforms. We achieve this by having a specific paper as the focus of every post and allowing only one summary per user per paper.

## 2 Approach

The [shortscience.org](#) platform provides three main features:

- Post summaries/notes on papers (public, private, or anonymous)
- Comment on summaries/notes
- Search, browse by venues, and follow users to find summaries/notes

Summaries can be written for any paper in three main databases, which includes anything with a DOI, on arXiv, or on Bibsonomy (3). These summaries can be voted on by each user using a simple up or down metric. Each summary can be set as private which is useful for personal organization of papers.

[shortscience.org](#) is run and managed by the Institute for Reproducible Research (IRR), which is a U.S. Non-Profit organization. The IRR also manages the project [academictorrents.com](#) which is a system facilitate the movement of large datasets for research (2; 1).

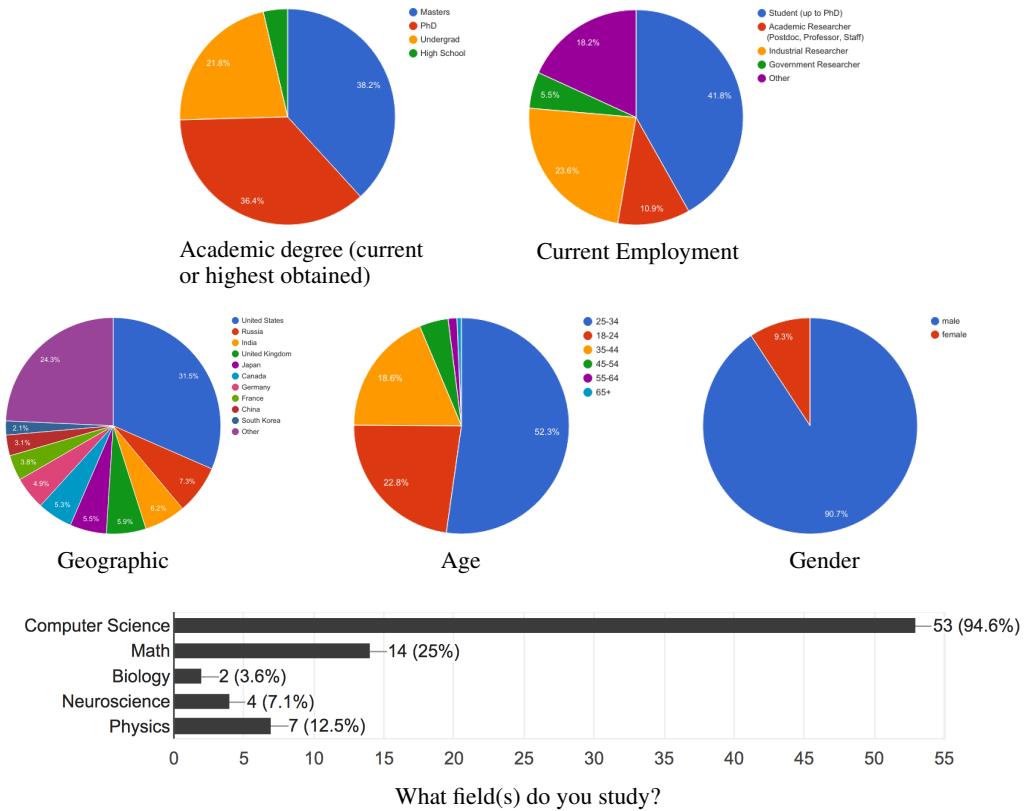


Figure 2: User demographics. Collected using a survey and website statistics

### 3 Community Impact

Over the last year of the site's operation, [shortscience.org](http://shortscience.org) has received 34,938 unique users to the 626 public and 83 private summaries. These users visited the site 118,874 times and spent an average duration of 1.41 minutes per visit. These users come from all over the world, have a primarily focus of Computer Science, are typically enrolled in Masters or PhD programs, and are younger than 30. More detailed demographics are shown in Figure 2.

Based on a sample of 55 users, we found:

- 60% of users read 5 or more summaries
- 87% of users found reading these summaries useful in understanding papers
- **82% of users read summaries for papers that they would not have otherwise read**

These usage statistics suggest that summaries are helpful for both readers, in terms of understanding, and for authors in terms of readers reached.

#### 3.1 Field

Although the project is meant for all majors most users identify as being in Computer Science. The majority of the content of the site is computer science and this is most likely due to the field of the creators being computer science. A major factor to explain this was that members of the machine learning community were already posting summaries and notes online using [github.com](https://github.com) or blog-like platforms. These users were contacted and encouraged to use the project.

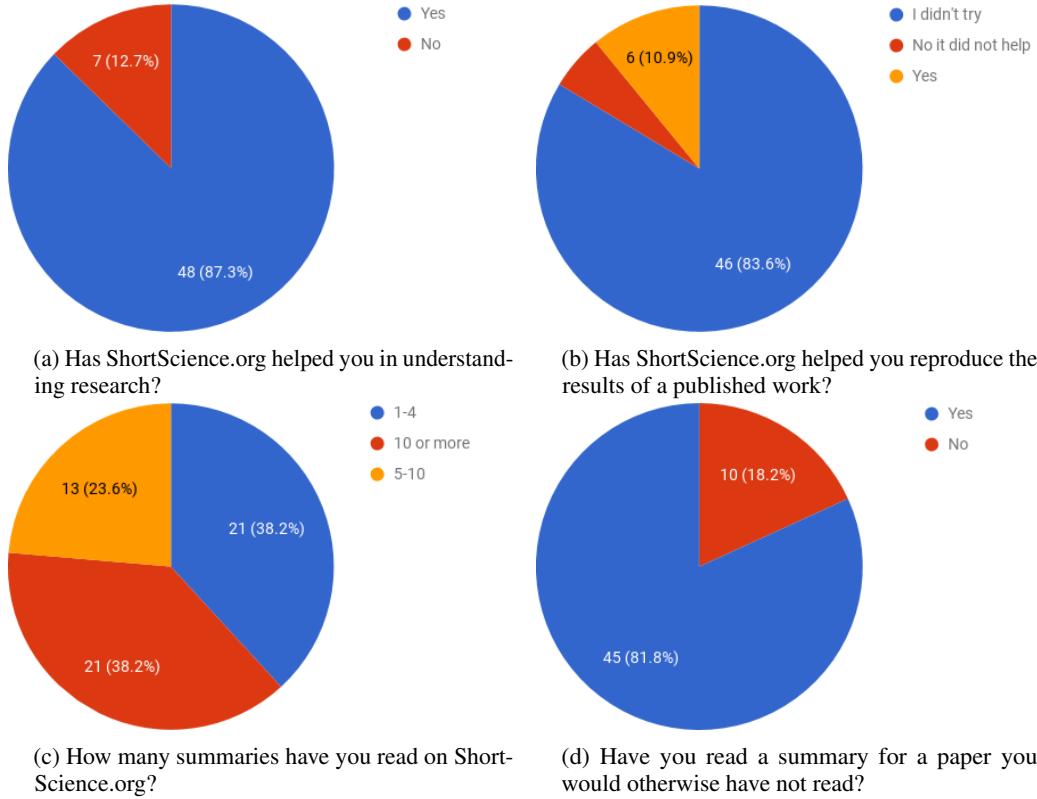


Figure 3: Questions on usage

### 3.2 Gender

We find an interesting trend in the gender of users where only 9.3% are female. Because the primary content on the site is Machine Learning related this may reflect a trend in Machine Learning that differs from Computer Science as a whole. The National Science Board's Science and Engineering Indicators report (5) states 25.3% (671,000/2,647,000) are employed as computer and mathematical scientists in 2016. Supporting this number the Survey of Earned Doctorates (6) reports 24% (943/3,825) earned a PhD in mathematics and computer sciences in 2015. These numbers could indicate a bias in Machine Learning or that this approach does not work well for women. However, the 9.3% number matches an informal assessment of the machine learning labs we have visited.

### 3.3 Reproducibility

We define reproducibility as recreating the intuition the author tried to describe in their paper and as recreating the experiments in order to verify results. Recreating an experiment alone will not guarantee the intuition can be passed on to the reader, however recreating the intuition directly can enable a research to implement their own solution to verify results.

We assess intuition reproducibility explicitly with user reported success in Figure 4. In our survey we found 87% of users were able to use the platform to understand a research paper. While the majority of users did not try to directly reproduce research using the site, 10.9% (6/55 users surveyed) did and were successful while 5.5% (3/55) reported the platform not helping them and 83.7% (46/55) didn't try to reproduce results.

### 3.4 Usefulness

Responses from the survey (4a) indicate that the project is perceived to be useful. A more detailed version of this poll is shown in Figure 4b which allows us to use the Net Promoter Score (NPS) evaluation (4). Here we ask the question "How likely are you to recommend `shortscience.org`

to a friend or colleague?" and present 11 choices between 0 and 10. From the responses the NPS is calculated as  $\frac{\# \text{ promoters} - \# \text{ detractors}}{\# \text{ total respondents}}$  where promoters are those who responded 9 – 10 and detractors responded between 0 – 6. The European variant accounts for respondents giving lower scores even though they are satisfied and alters these numbers to 8 – 10 and 0 – 5. We observe a score of 31 using the U.S. scale and 60 using the European variant. The scores range between –100 and +100 so we score well on this analysis. Given that only 30% of the users are from the U.S. our true score is somewhere in between.

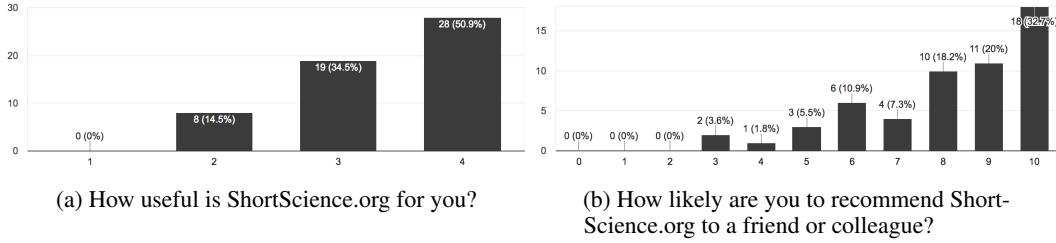


Figure 4: General sentiment towards the site

## 4 Conclusion

Here we presented `shortscience.org` which aims to make research more accessible by making the ideas more understandable. After one year of operation we are making a reasonable impact. The future looks strong for the project given 72.7% of users reported they will write a summary in the future. Based on this we conclude there will be much future growth given that many Masters and PhD students will continue in academia. Many users called for us to advertise the project more as well as make UI improvements and add features.

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