ATLAS: Interactive and Educational Linear Algebra System Containing Non-Standard Methods

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30 July 2021 at MathUI/CICM 2021

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- ATLAS aims to also provide the ability to compare the step-by-step solutions of methods simultaneously
- By providing non-standard methods and step-by-step solutions for all methods, users have a greater choice and they can see exactly how problems can be solved using the methods

Prior Work I

Maple   Maple has a feature called Tutor, allowing users to view the step-by-step solutions to a problem for linear algebra functions, such as calculation of eigenvalues [Map21]. Tutor may explain the popularity of Maple amongst students, as it can serves as a key tool in their education. However, this feature is also limited to only standard methods. Developing a Tutor-style feature in a linear algebra system, however, combined with non-standard methods could allow different methods to be compared against each other.

MATLAB MATLAB does not contain a step-by-step solution feature. But users need to learn a new programming language to utilise it. It also does not offer alternative methods, such as Strassen's method. [Han09] conducted a study about whether MATLAB can act as a useful tool to supplement the learning of university students. Most students liked using MATLAB, with specific preference amongst lower achieving students as they liked getting an answer without working it out, which is not very helpful for their learning. Some students, however, did not like it because it did not show how it got to the answer and they wanted to see how the problem was solved step-by-step, otherwise it wouldn't help them. Some students also stated that they were "not good at computers", highlighting the need for simplicity in a linear algebra system for users who are unfamiliar with computers or programming.

Prior Work III

CoCalc CoCalc [Ste18] is web-based linear algebra system, which
makes it more portable than Maple or MATLAB. CoCalc
allows collaboration by multiple collaborators simultaneously
[Sag21], in addition to allowing teachers to conduct their
lessons entirely on CoCalc through an interactive platform.
Whilst this is an interesting idea, it does little to directly help
students to learn independently. Based on the features
available, CoCalc acts more as an e-learning platform such as
Moodle, used by many universities. CoCalc also suffers some
of the flaws of MATLAB, such that users would need to learn
new programming languages to utilise CoCalc.

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- Systems of linear equations can be solved by Gaussian elimination, Cramer's rule and Cholesky decomposition, whilst being compared with each other simultaneously

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- There is a desire to extend to comparisons of methods that are considered numerically good or bad to understand the effect of different methods on problems with floating point numbers.
- Also, there is an aspiration to improve the portability of ATLAS by creating a web-based equivalent, similar to CoCalc.

Demo Now we shall demonstrate some of the functionality of ATLAS

? Any questions?

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