Linear Algebra Courses

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Note: These views reflect my personal opinions.

Someone in class asked what classes they should take if they want to explore linear algebra more. As Prof. Khayms mentioned, this is a broad subject with many different applications, so there are in fact *a lot* of courses to choose from. Just a search for "linear algebra" on ExploreCourses returns 125 results. Here I offer some suggestions, ordered roughly by difficulty. These are the courses that I have taken or are fairly familiar with.

1 Theoretical

- CME 200 (ME 300A): Linear Algebra with Application to Engineering Computations. Another great introduction to fundamental tools and properties in linear algebra. The focus is on vector spaces and understanding matrix manipulations.
- MATH 104: Applied Matrix Theory. Similar to CME 103, but the focus is on algorithms and concepts, as would be expected from the math department. Fairly broad survey of matrix methods though.
- MATH 113: The theoretical version of MATH 104, taken primarily by math majors and other interested folks. Could be a rewarding class if you want to really understand linear algebra and practice writing proofs.
- CS 229 (STATS 229): Machine Learning. The infamous 1000-person course with a 35-page midterm (rip me). In all seriousness, this course does try to survey the main methods in all of machine learning, with a focus on the mathematical side. You will definitely learn a lot of linear algebra and matrix calculus.
- CS 269O (MS&E 213): Introduction to Optimization Theory. The theoretical focus to optimization means writing 0 lines of code and many proofs on the bounds of various optimization algorithms. Will my algorithm converge? How fast will it converge? Lots of fun matrix-vector manipulations.
- EE 364A (CME 364A, CS 334A): Convex Optimization I. Intense linear algebra applied to the field of optimization. You've probably heard about this infamous class, and it is quite a bit of work. I've never taken it personally, but Stephen Boyd is loved by many students. If you also want to know what a 24-hour take-home midterm/final is like, here's your chance.
- CS 229T (STATS 231): Statistical Learning Theory. As if CS 229 wasn't theoretical enough, here's your chance to dive deeper. Most definitely an advanced linear algebra course and for those that enjoy proofs.
- CME 302: Numerical Linear Algebra. I'm in this class right now, and it's a doozy. The focus is on scientific computing and how we can make operations faster. Fast paced, and would not recommend without an intermediate linear algebra prerequisite.

2 Applied

- CME 103 (EE 103): Introduction to Matrix Methods. An introductory course to fundamental tools and properties in linear algebra. Many applications are reviewed.
- CME 104: Linear Algebra and Partial Differential Equations. The best class of my freshman year ;) You will cover more linear algebra with the focus on solving systems related to partial differential equations. It'll probably be one of the more intense classes you'll take at Stanford, but it's extremely rewarding, particularly if you enjoy Prof. Khayms' teaching.
- CS 131: Computer Vision: Foundations and Applications. Another prime example of applied linear algebra is in the field of computer vision, image processing, and machine learning. I haven't taken this course, but I presume it requires you to do matrix factorization and multiplications to understand the computational framework.
- STATS 216: Introduction to Statistical Learning. A "math-light course" (their words not mine) that introduces you to the main methods encountered in the field of statistical/machine learning. You'll need linear algebra to really understand what's going on, but perhaps proofs are not the focus of the course.
- CS 224N: Natural Language Processing with Deep Learning. Natural language processing is using a computer to understand language (e.g. machine translation, question-answer bot, speech transcription). Another machine learning application where linear algebra is critical to the computations in deep neural networks.
- CS 231A and CS 231N: Computer Vision / Convolutional Neural Networks. Two intermediate level courses (beyond CS 131) that look at advanced techniques in computer vision and the math that goes on behind the scenes.
- EE 263 (CME 263): Introduction to Linear Dynamical Systems. The intermediate version of CME 103, with a deeper look into matrix properties and applications. Would not recommend taking without some mathematical maturity.