Using AI for Software

April, 2023

Table of Contents

# About this Course

## 0.1 Available course formats

This course is available in multiple formats which allows you to take it in the way that best suites your needs. You can take it for certificate which can be for free or fee.

* The material for this course can be viewed without login requirement on this [Bookdown website](LINK%20HERE). This format might be most appropriate for you if you rely on screen-reader technology.
* This course can be taken for [free certification through Leanpub](LINK%20HERE).
* This course can be taken on [Coursera for certification here](LINK%20HERE) (but it is not available for free on Coursera).
* Our courses are open source, you can find the [source material for this course on GitHub](LINK%20HERE).

# 1 Introduction

The increasing availability of AI chatbots is creating a new landscape in software development. While the future of those who work with code is uncertain, there are valid concerns about the potential for AI bots to replace or significantly reduce the workload of programmers, resulting in a loss of job opportunities. Additionally, there are significant ethical and privacy concerns regarding the use of training data sets to teach these AI systems.

Despite these worries, the widespread adoption of AI bots is ushering in a new era of computing, data science, and information interaction that presents many exciting possibilities. As AI bots become more ubiquitous, they have the potential to change the way we work with information and interact with machines. The rapid development of AI technology is creating exciting opportunities for programmers to develop innovative solutions to previously intractable problems.

Ultimately, while the future of software development is unclear, there is much to be optimistic about in this brave new world. The advancements in AI and chatbot technology present an opportunity for programmers to work alongside algorithms to create innovative solutions that were previously unimaginable. As with any technological revolution, there will be challenges, but it is up to us to work together to ensure that we use these tools ethically and responsibly, and to create a future that benefits everyone.

## 1.1 AI provides new opportunities

We do not believe that AI chatbots will replace software developers. While AI can be powerful and useful, it is only as good as the training data behind it and the human using it. Therefore, for the time being and the foreseeable future, humans will remain at the forefront of programming innovation, with AI providing valuable support. As new code is often built on top of existing code written by humans, it is unlikely that AI will fully replace the need for human programmers.

However, we *do* think that the roles of programmers in software development are changing, and some of the skills required to work in this new environment are slightly different from those needed before. In addition to proficiency in programming syntax, programmers may need to develop a more refined ability to construct queries that enable AI bots to create the desired workflows. Other critical skills such as debugging, troubleshooting, and documentation will continue to be valuable, and can be enhanced through the use of AI.

Furthermore, AI creates new opportunities and niches for tasks that were previously difficult, time-consuming, or impossible. This is an exciting time for those working in programming, with great potential to explore new and innovative solutions. As AI technology continues to advance, its role in programming will only become more significant, and it is up to developers to adapt and learn how to use these new tools effectively.

We asked OpenAI’s ChatGPT whether AI chatbots would replace human software developers and programmers, and this was the response:

“No, ChatGPT is not replacing human software developers and programmers. While ChatGPT is capable of generating code, it is not a substitute for the skills and expertise of human programmers.

Software development is a complex process that requires a deep understanding of programming languages, algorithms, and software design principles. Human programmers have the ability to not only write code, but also to understand the nuances of different programming languages and frameworks, debug code, and optimize performance.

Furthermore, programming is not just about writing code - it also involves understanding and translating business requirements into technical solutions, collaborating with other team members, and maintaining code over time.

While ChatGPT can be used to automate certain aspects of software development, it cannot replace the creativity, problem-solving skills, and domain expertise of human software developers and programmers.”

## 1.2 AI code of ethics

Our first duty as programmers is to avoid causing harm to people and the world. This includes avoiding both intentional and inadvertent harm. *Intentional harm* is harm that is caused by a programmer’s deliberate actions. For example, a programmer might create a virus that is designed to harm computers. *Inadvertent harm* is harm that is caused by a programmer’s negligence or lack of foresight. For example, a programmer might create a program that is buggy and causes data loss.

We must always be aware of the potential for harm and deliberately take steps to mitigate it. This includes things like:

**Be aware of the potential for bias.** AI systems are trained on data, and that data can reflect the biases of the people who collected it. Programmers should be aware of the potential for bias in their data and take steps to mitigate it.

**Be transparent about your work.** Share information about your code, data, and algorithms. This will help others to understand how your work works and to identify any potential problems.

**Be accountable for your work.** Take responsibility for the consequences of your code. Be willing to make changes if necessary.

**Participate in discussions about AI ethics.** There are many online and in-person communities where you can discuss the ethical implications of AI with other people.

**Advocate for ethical AI.** Speak up when you see AI being used in a way that you believe is unethical. Support organizations that are working to promote ethical AI.

## 1.3 About this book

We used AI bots to develop and write much of this course. We firmly believe this new technology can be used in ethical ways and we put into practice all the rules and suggestions offered over the following modules. It is up to the human behind it to make sure that AI is used properly and transparently.

devtools::session\_info()

## ─ Session info ───────────────────────────────────────────────────────────────  
## setting value   
## version R version 4.0.2 (2020-06-22)  
## os Ubuntu 20.04.5 LTS   
## system x86\_64, linux-gnu   
## ui X11   
## language (EN)   
## collate en\_US.UTF-8   
## ctype en\_US.UTF-8   
## tz Etc/UTC   
## date 2023-04-05   
##   
## ─ Packages ───────────────────────────────────────────────────────────────────  
## package \* version date lib source   
## assertthat 0.2.1 2019-03-21 [1] RSPM (R 4.0.5)   
## bookdown 0.24 2023-03-28 [1] Github (rstudio/bookdown@88bc4ea)   
## cachem 1.0.7 2023-02-24 [1] CRAN (R 4.0.2)   
## callr 3.5.0 2020-10-08 [1] RSPM (R 4.0.2)   
## cli 3.6.1 2023-03-23 [1] CRAN (R 4.0.2)   
## crayon 1.3.4 2017-09-16 [1] RSPM (R 4.0.0)   
## desc 1.2.0 2018-05-01 [1] RSPM (R 4.0.3)   
## devtools 2.3.2 2020-09-18 [1] RSPM (R 4.0.3)   
## digest 0.6.25 2020-02-23 [1] RSPM (R 4.0.0)   
## ellipsis 0.3.1 2020-05-15 [1] RSPM (R 4.0.3)   
## evaluate 0.20 2023-01-17 [1] CRAN (R 4.0.2)   
## fansi 0.4.1 2020-01-08 [1] RSPM (R 4.0.0)   
## fastmap 1.1.1 2023-02-24 [1] CRAN (R 4.0.2)   
## fs 1.5.0 2020-07-31 [1] RSPM (R 4.0.3)   
## glue 1.4.2 2020-08-27 [1] RSPM (R 4.0.5)   
## hms 0.5.3 2020-01-08 [1] RSPM (R 4.0.0)   
## htmltools 0.5.5 2023-03-23 [1] CRAN (R 4.0.2)   
## knitr 1.33 2023-03-28 [1] Github (yihui/knitr@a1052d1)   
## lifecycle 1.0.3 2022-10-07 [1] CRAN (R 4.0.2)   
## magrittr 2.0.3 2022-03-30 [1] CRAN (R 4.0.2)   
## memoise 2.0.1 2021-11-26 [1] CRAN (R 4.0.2)   
## ottrpal 1.0.1 2023-03-28 [1] Github (jhudsl/ottrpal@151e412)   
## pillar 1.9.0 2023-03-22 [1] CRAN (R 4.0.2)   
## pkgbuild 1.1.0 2020-07-13 [1] RSPM (R 4.0.2)   
## pkgconfig 2.0.3 2019-09-22 [1] RSPM (R 4.0.3)   
## pkgload 1.1.0 2020-05-29 [1] RSPM (R 4.0.3)   
## prettyunits 1.1.1 2020-01-24 [1] RSPM (R 4.0.3)   
## processx 3.4.4 2020-09-03 [1] RSPM (R 4.0.2)   
## ps 1.4.0 2020-10-07 [1] RSPM (R 4.0.2)   
## R6 2.4.1 2019-11-12 [1] RSPM (R 4.0.0)   
## readr 1.4.0 2020-10-05 [1] RSPM (R 4.0.2)   
## remotes 2.2.0 2020-07-21 [1] RSPM (R 4.0.3)   
## rlang 1.1.0 2023-03-14 [1] CRAN (R 4.0.2)   
## rmarkdown 2.10 2023-03-28 [1] Github (rstudio/rmarkdown@02d3c25)  
## rprojroot 2.0.3 2022-04-02 [1] CRAN (R 4.0.2)   
## sessioninfo 1.1.1 2018-11-05 [1] RSPM (R 4.0.3)   
## stringi 1.5.3 2020-09-09 [1] RSPM (R 4.0.3)   
## stringr 1.4.0 2019-02-10 [1] RSPM (R 4.0.3)   
## testthat 3.0.1 2023-03-28 [1] Github (R-lib/testthat@e99155a)   
## tibble 3.2.1 2023-03-20 [1] CRAN (R 4.0.2)   
## usethis 1.6.3 2020-09-17 [1] RSPM (R 4.0.2)   
## utf8 1.1.4 2018-05-24 [1] RSPM (R 4.0.3)   
## vctrs 0.6.1 2023-03-22 [1] CRAN (R 4.0.2)   
## withr 2.3.0 2020-09-22 [1] RSPM (R 4.0.2)   
## xfun 0.26 2023-03-28 [1] Github (yihui/xfun@74c2a66)   
## yaml 2.2.1 2020-02-01 [1] RSPM (R 4.0.3)   
##   
## [1] /usr/local/lib/R/site-library  
## [2] /usr/local/lib/R/library