

authors, etc.

Recommendation Systems From Introduction to Empirical Research

May 7, 2024

Springer Nature

Contents

1	Introduction to Recommendation Systems	1
1.1	Evolution of Recommendation Systems	1
1.2	Applications of Recommendation Systems	1
1.3	Advanced Topics in Recommendation Systems	1
1.4	Summary	1
1.5	Bibliographic Notes	1
	References	1
2	Traditional Recommendation Systems	3
2.1	Collaborative Filtering	3
2.2	Content-based Recommendation Systems	3
2.3	Knowledge-based Recommendation Systems	3
2.4	Ensemble Recommendation Systems	3
	References	3
3	Deep Recommendation Models	7
3.1	CNN-based Recommendation Models	7
3.2	RNN-based Recommendation Models	7
3.3	Deep RL-based Recommendation Models	7
3.4	Deep Embeddings	7
3.5	Transformers in Recommendation Systems	7
3.6	Hybrid Recommendation Models	7
	References	7
4	Hybrid Recommendation Systems	11
4.1	Deep Feature Processing Modules	11
4.2	Deep Retrieval Modules	11
4.3	Deep Ranking Modules	11
4.4	Hybrid Schemes	11
	References	11

5	Empirical Recommendation Systems	15
5.1	Web-based Recommendation Systems	15
5.1.1	Image Recommendation Systems	15
5.1.2	Video Recommendation Systems	15
5.1.3	Product Recommendation Systems	15
5.1.4	Social Recommendation Systems	15
	References	15
6	System Evaluations	19
6.1	Offline Performance Metrics	19
6.2	Online Evaluations	19
6.2.1	Online Metrics	19
6.2.2	A/B Testing	19
6.2.3	Interleaving	19
	References	19
7	Advanced Topics	23
7.1	Context Sensitivity	23
7.2	Time and Location Sensitivity	23
7.3	Sociality and Trust	23
7.4	Attack Resistance	23
7.5	Fair Recommendation	23
7.6	Privacy Preservation	23
7.7	Personalization	23
	References	23
A	Appendix	27
A.1	Math Appendix	27
	Glossary	29
	Index	31

Acronyms

Use the template *acronym.tex* together with the document class SVMono (monograph-type books) or SVMult (edited books) to style your list(s) of abbreviations or symbols.

Lists of abbreviations, symbols and the like are easily formatted with the help of the Springer-enhanced `description` environment.

ABC	Spelled-out abbreviation and definition
BABI	Spelled-out abbreviation and definition
CABR	Spelled-out abbreviation and definition

Chapter 1

Introduction to Recommendation Systems

Abstract Recommendation systems nowadays are widely used in various industries, including business, IT, Pharmacy and government, etc.. Along with the development and thrive of WWW and other important computer techniques, such as IOT and neural network, the breath and depth of the use of recommendation systems have improved significantly. In this chapter, we highlight the evolution of recommendation systems. Discuss the use of recommendation systems in our daily life and beyond. Finally, we briefly discuss advanced topics in the area and leave the details to be elaborated in later chapters.

1.1 Evolution of Recommendation Systems

1.2 Applications of Recommendation Systems

1.3 Advanced Topics in Recommendation Systems

1.4 Summary

1.5 Bibliographic Notes

References

In view of the parallel print and (chapter-wise) online publication of your book at www.springerlink.com it has been decided that – as a general rule – references should be sorted chapter-wise and placed at the end of the individual chapters. However, upon agreement with your contact at Springer you may list your references in a single separate chapter at the end of your book. Deactivate the class option

sectrefs and the thebibliography environment will be put out as a chapter of its own.

References may be *cited* in the text either by number (preferred) or by author/year.¹ If the citatiion in the text is numbered, the reference list should be arranged in ascending order. If the citation in the text is author/year, the reference list should be *sorted* alphabetically and if there are several works by the same author, the following order should be used:

1. Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) The rise of modern genomics, 3rd edn. Wiley, New York

¹ Make sure that all references from the list are cited in the text. Those not cited should be moved to a separate *Further Reading* section or chapter.

Chapter 2

Traditional Recommendation Systems

Abstract

2.1 Collaborative Filtering

2.2 Content-based Recommendation Systems

2.3 Knowledge-based Recommendation Systems

2.4 Ensemble Recommendation Systems

References

In view of the parallel print and (chapter-wise) online publication of your book at www.springerlink.com it has been decided that – as a general rule – references should be sorted chapter-wise and placed at the end of the individual chapters. However, upon agreement with your contact at Springer you may list your references in a single separate chapter at the end of your book. Deactivate the class option `sectrefs` and the `thebibliography` environment will be put out as a chapter of its own.

References may be *cited* in the text either by number (preferred) or by author/year.¹ If the citation in the text is numbered, the reference list should be arranged in ascending order. If the citation in the text is author/year, the reference list should be *sorted* alphabetically and if there are several works by the same author, the following order should be used:

¹ Make sure that all references from the list are cited in the text. Those not cited should be moved to a separate *Further Reading* section or chapter.

1. all works by the author alone, ordered chronologically by year of publication
2. all works by the author with a coauthor, ordered alphabetically by coauthor
3. all works by the author with several coauthors, ordered chronologically by year of publication.

The *styling* of references² depends on the subject of your book:

- The *two* recommended styles for references in books on *mathematical, physical, statistical and computer sciences* are depicted in [1–5] and [6–10].
 - Examples of the most commonly used reference style in books on *Psychology, Social Sciences* are [11–15].
 - Examples for references in books on *Humanities, Linguistics, Philosophy* are [16–20].
 - Examples of the basic Springer style used in publications on a wide range of subjects such as *Computer Science, Economics, Engineering, Geosciences, Life Sciences, Medicine, Biomedicine* are [21–25].
1. Broy, M.: Software engineering — from auxiliary to key technologies. In: Broy, M., Dener, E. (eds.) *Software Pioneers*, pp. 10–13. Springer, Heidelberg (2002)
 2. Dod, J.: Effective substances. In: *The Dictionary of Substances and Their Effects*. Royal Society of Chemistry (1999) Available via DIALOG. [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
 3. Geddes, K.O., Czapor, S.R., Labahn, G.: *Algorithms for Computer Algebra*. Kluwer, Boston (1992)
 4. Hamburger, C.: Quasimonotonicity, regularity and duality for nonlinear systems of partial differential equations. *Ann. Mat. Pura. Appl.* **169**, 321–354 (1995)
 5. Slifka, M.K., Whitton, J.L.: Clinical implications of dysregulated cytokine production. *J. Mol. Med.* (2000) doi: 10.1007/s001090000086
 6. J. Dod, in *The Dictionary of Substances and Their Effects*, Royal Society of Chemistry. (Available via DIALOG, 1999), [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
 7. H. Ibach, H. Lüth, *Solid-State Physics*, 2nd edn. (Springer, New York, 1996), pp. 45–56
 8. S. Preuss, A. Demchuk Jr., M. Stuke, *Appl. Phys. A* **61**
 9. M.K. Slifka, J.L. Whitton, *J. Mol. Med.*, doi: 10.1007/s001090000086
 10. S.E. Smith, in *Neuromuscular Junction*, ed. by E. Zaimis. *Handbook of Experimental Pharmacology*, vol 42 (Springer, Heidelberg, 1976), p. 593
 11. Calfee, R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.
 12. Dod, J. (1999). Effective substances. In: *The dictionary of substances and their effects*. Royal Society of Chemistry. Available via DIALOG. [http://www.rsc.org/dose/Effective substances](http://www.rsc.org/dose/Effective%20substances). Cited 15 Jan 1999.
 13. Harris, M., Karper, E., Stacks, G., Hoffman, D., DeNiro, R., Cruz, P., et al. (2001). Writing labs and the Hollywood connection. *J Film Writing*, 44(3), 213–245.
 14. O’Neil, J. M., & Egan, J. (1992). Men’s and women’s gender role journeys: Metaphor for healing, transition, and transformation. In B. R. Wainrig (Ed.), *Gender issues across the life cycle* (pp. 107–123). New York: Springer.

² Always use the standard abbreviation of a journal’s name according to the *ISSN List of Title Word Abbreviations*, see <http://www.issn.org/en/node/344>

15. Kreger, M., Brindis, C.D., Manuel, D.M., Sassoubre, L. (2007). Lessons learned in systems change initiatives: benchmarks and indicators. *American Journal of Community Psychology*, doi: 10.1007/s10464-007-9108-14.
16. Alber John, Daniel C. O'Connell, and Sabine Kowal. 2002. Personal perspective in TV interviews. *Pragmatics* 12:257–271
17. Cameron, Deborah. 1997. Theoretical debates in feminist linguistics: Questions of sex and gender. In *Gender and discourse*, ed. Ruth Wodak, 99–119. London: Sage Publications.
18. Cameron, Deborah. 1985. *Feminism and linguistic theory*. New York: St. Martin's Press.
19. Dod, Jake. 1999. Effective substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
<http://www.rsc.org/dose/title> of subordinate document. Cited 15 Jan 1999
20. Suleiman, Camelia, Daniel C. O'Connell, and Sabine Kowal. 2002. 'If you and I, if we, in this later day, lose that sacred fire...': Perspective in political interviews. *Journal of Psycholinguistic Research*. doi: 10.1023/A:1015592129296.
21. Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) The rise of modern genomics, 3rd edn. Wiley, New York
22. Dod J (1999) Effective Substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
<http://www.rsc.org/dose/title> of subordinate document. Cited 15 Jan 1999
23. Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. *J Mol Med*, doi: 10.1007/s001090000086
24. Smith J, Jones M Jr, Houghton L et al (1999) Future of health insurance. *N Engl J Med* 341:325–329
25. South J, Blass B (2001) The future of modern genomics. Blackwell, London

Chapter 3

Deep Recommendation Models

3.1 CNN-based Recommendation Models

3.2 RNN-based Recommendation Models

3.3 Deep RL-based Recommendation Models

3.4 Deep Embeddings

3.5 Transformers in Recommendation Systems

3.6 Hybrid Recommendation Models

References

In view of the parallel print and (chapter-wise) online publication of your book at www.springerlink.com it has been decided that – as a general rule – references should be sorted chapter-wise and placed at the end of the individual chapters. However, upon agreement with your contact at Springer you may list your references in a single separate chapter at the end of your book. Deactivate the class option `sectrefs` and the `thebibliography` environment will be put out as a chapter of its own.

References may be *cited* in the text either by number (preferred) or by author/year.¹ If the citation in the text is numbered, the reference list should be arranged in ascending order. If the citation in the text is author/year, the reference list should be

¹ Make sure that all references from the list are cited in the text. Those not cited should be moved to a separate *Further Reading* section or chapter.

sorted alphabetically and if there are several works by the same author, the following order should be used:

1. all works by the author alone, ordered chronologically by year of publication
2. all works by the author with a coauthor, ordered alphabetically by coauthor
3. all works by the author with several coauthors, ordered chronologically by year of publication.

The *styling* of references² depends on the subject of your book:

- The *two* recommended styles for references in books on *mathematical, physical, statistical and computer sciences* are depicted in [1–5] and [6–10].
 - Examples of the most commonly used reference style in books on *Psychology, Social Sciences* are [11–15].
 - Examples for references in books on *Humanities, Linguistics, Philosophy* are [16–20].
 - Examples of the basic Springer style used in publications on a wide range of subjects such as *Computer Science, Economics, Engineering, Geosciences, Life Sciences, Medicine, Biomedicine* are [21–25].
1. Broy, M.: Software engineering — from auxiliary to key technologies. In: Broy, M., Dener, E. (eds.) *Software Pioneers*, pp. 10–13. Springer, Heidelberg (2002)
 2. Dod, J.: Effective substances. In: *The Dictionary of Substances and Their Effects*. Royal Society of Chemistry (1999) Available via DIALOG. [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
 3. Geddes, K.O., Czapor, S.R., Labahn, G.: *Algorithms for Computer Algebra*. Kluwer, Boston (1992)
 4. Hamburger, C.: Quasimonotonicity, regularity and duality for nonlinear systems of partial differential equations. *Ann. Mat. Pura. Appl.* **169**, 321–354 (1995)
 5. Slifka, M.K., Whitton, J.L.: Clinical implications of dysregulated cytokine production. *J. Mol. Med.* (2000) doi: 10.1007/s001090000086
 6. J. Dod, in *The Dictionary of Substances and Their Effects*, Royal Society of Chemistry. (Available via DIALOG, 1999), [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
 7. H. Ibach, H. Lüth, *Solid-State Physics*, 2nd edn. (Springer, New York, 1996), pp. 45–56
 8. S. Preuss, A. Demchuk Jr., M. Stuke, *Appl. Phys. A* **61**
 9. M.K. Slifka, J.L. Whitton, *J. Mol. Med.*, doi: 10.1007/s001090000086
 10. S.E. Smith, in *Neuromuscular Junction*, ed. by E. Zaimis. *Handbook of Experimental Pharmacology*, vol 42 (Springer, Heidelberg, 1976), p. 593
 11. Calfee, R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.
 12. Dod, J. (1999). Effective substances. In: *The dictionary of substances and their effects*. Royal Society of Chemistry. Available via DIALOG. [http://www.rsc.org/dose/Effective substances](http://www.rsc.org/dose/Effective%20substances). Cited 15 Jan 1999.
 13. Harris, M., Karper, E., Stacks, G., Hoffman, D., DeNiro, R., Cruz, P., et al. (2001). Writing labs and the Hollywood connection. *J Film Writing*, 44(3), 213–245.

² Always use the standard abbreviation of a journal's name according to the *ISSN List of Title Word Abbreviations*, see <http://www.issn.org/en/node/344>

14. O'Neil, J. M., & Egan, J. (1992). Men's and women's gender role journeys: Metaphor for healing, transition, and transformation. In B. R. Wainrig (Ed.), *Gender issues across the life cycle* (pp. 107–123). New York: Springer.
15. Kreger, M., Brindis, C.D., Manuel, D.M., Sassoubre, L. (2007). Lessons learned in systems change initiatives: benchmarks and indicators. *American Journal of Community Psychology*, doi: 10.1007/s10464-007-9108-14.
16. Alber John, Daniel C. O'Connell, and Sabine Kowal. 2002. Personal perspective in TV interviews. *Pragmatics* 12:257–271
17. Cameron, Deborah. 1997. Theoretical debates in feminist linguistics: Questions of sex and gender. In *Gender and discourse*, ed. Ruth Wodak, 99–119. London: Sage Publications.
18. Cameron, Deborah. 1985. *Feminism and linguistic theory*. New York: St. Martin's Press.
19. Dod, Jake. 1999. Effective substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
[http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
20. Suleiman, Camelia, Daniel C. O'Connell, and Sabine Kowal. 2002. 'If you and I, if we, in this later day, lose that sacred fire...': Perspective in political interviews. *Journal of Psycholinguistic Research*. doi: 10.1023/A:1015592129296.
21. Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) The rise of modern genomics, 3rd edn. Wiley, New York
22. Dod J (1999) Effective Substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
[http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
23. Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. *J Mol Med*, doi: 10.1007/s001090000086
24. Smith J, Jones M Jr, Houghton L et al (1999) Future of health insurance. *N Engl J Med* 341:325–329
25. South J, Blass B (2001) The future of modern genomics. Blackwell, London

Chapter 4

Hybrid Recommendation Systems

4.1 Deep Feature Processing Modules

4.2 Deep Retrieval Modules

4.3 Deep Ranking Modules

4.4 Hybrid Schemes

References

In view of the parallel print and (chapter-wise) online publication of your book at www.springerlink.com it has been decided that – as a general rule – references should be sorted chapter-wise and placed at the end of the individual chapters. However, upon agreement with your contact at Springer you may list your references in a single separate chapter at the end of your book. Deactivate the class option `sectrefs` and the `thebibliography` environment will be put out as a chapter of its own.

References may be *cited* in the text either by number (preferred) or by author/year.¹ If the citation in the text is numbered, the reference list should be arranged in ascending order. If the citation in the text is author/year, the reference list should be *sorted* alphabetically and if there are several works by the same author, the following order should be used:

1. all works by the author alone, ordered chronologically by year of publication
2. all works by the author with a coauthor, ordered alphabetically by coauthor
3. all works by the author with several coauthors, ordered chronologically by year of publication.

¹ Make sure that all references from the list are cited in the text. Those not cited should be moved to a separate *Further Reading* section or chapter.

The *styling* of references² depends on the subject of your book:

- The *two* recommended styles for references in books on *mathematical, physical, statistical and computer sciences* are depicted in [1–5] and [6–10].
 - Examples of the most commonly used reference style in books on *Psychology, Social Sciences* are [11–15].
 - Examples for references in books on *Humanities, Linguistics, Philosophy* are [16–20].
 - Examples of the basic Springer style used in publications on a wide range of subjects such as *Computer Science, Economics, Engineering, Geosciences, Life Sciences, Medicine, Biomedicine* are [21–25].
1. Broy, M.: Software engineering — from auxiliary to key technologies. In: Broy, M., Dener, E. (eds.) *Software Pioneers*, pp. 10–13. Springer, Heidelberg (2002)
 2. Dod, J.: Effective substances. In: *The Dictionary of Substances and Their Effects*. Royal Society of Chemistry (1999) Available via DIALOG. [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
 3. Geddes, K.O., Czapor, S.R., Labahn, G.: *Algorithms for Computer Algebra*. Kluwer, Boston (1992)
 4. Hamburger, C.: Quasimonotonicity, regularity and duality for nonlinear systems of partial differential equations. *Ann. Mat. Pura. Appl.* **169**, 321–354 (1995)
 5. Slifka, M.K., Whitton, J.L.: Clinical implications of dysregulated cytokine production. *J. Mol. Med.* (2000) doi: 10.1007/s001090000086
 6. J. Dod, in *The Dictionary of Substances and Their Effects*, Royal Society of Chemistry. (Available via DIALOG, 1999), [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
 7. H. Ibach, H. Lüth, *Solid-State Physics*, 2nd edn. (Springer, New York, 1996), pp. 45–56
 8. S. Preuss, A. Demchuk Jr., M. Stuke, *Appl. Phys. A* **61**
 9. M.K. Slifka, J.L. Whitton, *J. Mol. Med.*, doi: 10.1007/s001090000086
 10. S.E. Smith, in *Neuromuscular Junction*, ed. by E. Zaimis. *Handbook of Experimental Pharmacology*, vol 42 (Springer, Heidelberg, 1976), p. 593
 11. Calfee, R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.
 12. Dod, J. (1999). Effective substances. In: *The dictionary of substances and their effects*. Royal Society of Chemistry. Available via DIALOG. [http://www.rsc.org/dose/Effective substances](http://www.rsc.org/dose/Effective%20substances). Cited 15 Jan 1999.
 13. Harris, M., Karper, E., Stacks, G., Hoffman, D., DeNiro, R., Cruz, P., et al. (2001). Writing labs and the Hollywood connection. *J Film Writing*, 44(3), 213–245.
 14. O’Neil, J. M., & Egan, J. (1992). Men’s and women’s gender role journeys: Metaphor for healing, transition, and transformation. In B. R. Wainrig (Ed.), *Gender issues across the life cycle* (pp. 107–123). New York: Springer.
 15. Kreger, M., Brindis, C.D., Manuel, D.M., Sassoubre, L. (2007). Lessons learned in systems change initiatives: benchmarks and indicators. *American Journal of Community Psychology*, doi: 10.1007/s10464-007-9108-14.
 16. Alber John, Daniel C. O’Connell, and Sabine Kowal. 2002. Personal perspective in TV interviews. *Pragmatics* 12:257–271

² Always use the standard abbreviation of a journal’s name according to the *ISSN List of Title Word Abbreviations*, see <http://www.issn.org/en/node/344>

17. Cameron, Deborah. 1997. Theoretical debates in feminist linguistics: Questions of sex and gender. In *Gender and discourse*, ed. Ruth Wodak, 99–119. London: Sage Publications.
18. Cameron, Deborah. 1985. *Feminism and linguistic theory*. New York: St. Martin's Press.
19. Dod, Jake. 1999. Effective substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
<http://www.rsc.org/dose/title> of subordinate document. Cited 15 Jan 1999
20. Suleiman, Camelia, Daniel C. O'Connell, and Sabine Kowal. 2002. 'If you and I, if we, in this later day, lose that sacred fire...': Perspective in political interviews. *Journal of Psycholinguistic Research*. doi: 10.1023/A:1015592129296.
21. Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) The rise of modern genomics, 3rd edn. Wiley, New York
22. Dod J (1999) Effective Substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
<http://www.rsc.org/dose/title> of subordinate document. Cited 15 Jan 1999
23. Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. *J Mol Med*, doi: 10.1007/s001090000086
24. Smith J, Jones M Jr, Houghton L et al (1999) Future of health insurance. *N Engl J Med* 341:325–329
25. South J, Blass B (2001) The future of modern genomics. Blackwell, London

Chapter 5

Empirical Recommendation Systems

5.1 Web-based Recommendation Systems

5.1.1 Image Recommendation Systems

5.1.2 Video Recommendation Systems

5.1.3 Product Recommendation Systems

5.1.4 Social Recommendation Systems

References

In view of the parallel print and (chapter-wise) online publication of your book at www.springerlink.com it has been decided that – as a general rule – references should be sorted chapter-wise and placed at the end of the individual chapters. However, upon agreement with your contact at Springer you may list your references in a single separate chapter at the end of your book. Deactivate the class option `sectrefs` and the `thebibliography` environment will be put out as a chapter of its own.

References may be *cited* in the text either by number (preferred) or by author/year.¹ If the citation in the text is numbered, the reference list should be arranged in ascending order. If the citation in the text is author/year, the reference list should be *sorted* alphabetically and if there are several works by the same author, the following order should be used:

1. all works by the author alone, ordered chronologically by year of publication

¹ Make sure that all references from the list are cited in the text. Those not cited should be moved to a separate *Further Reading* section or chapter.

2. all works by the author with a coauthor, ordered alphabetically by coauthor
3. all works by the author with several coauthors, ordered chronologically by year of publication.

The *styling* of references² depends on the subject of your book:

- The *two* recommended styles for references in books on *mathematical, physical, statistical and computer sciences* are depicted in [1–5] and [6–10].
 - Examples of the most commonly used reference style in books on *Psychology, Social Sciences* are [11–15].
 - Examples for references in books on *Humanities, Linguistics, Philosophy* are [16–20].
 - Examples of the basic Springer style used in publications on a wide range of subjects such as *Computer Science, Economics, Engineering, Geosciences, Life Sciences, Medicine, Biomedicine* are [21–25].
1. Broy, M.: Software engineering — from auxiliary to key technologies. In: Broy, M., Dener, E. (eds.) *Software Pioneers*, pp. 10–13. Springer, Heidelberg (2002)
 2. Dod, J.: Effective substances. In: *The Dictionary of Substances and Their Effects*. Royal Society of Chemistry (1999) Available via DIALOG. [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
 3. Geddes, K.O., Czapor, S.R., Labahn, G.: *Algorithms for Computer Algebra*. Kluwer, Boston (1992)
 4. Hamburger, C.: Quasimonotonicity, regularity and duality for nonlinear systems of partial differential equations. *Ann. Mat. Pura. Appl.* **169**, 321–354 (1995)
 5. Slifka, M.K., Whitton, J.L.: Clinical implications of dysregulated cytokine production. *J. Mol. Med.* (2000) doi: 10.1007/s001090000086
 6. J. Dod, in *The Dictionary of Substances and Their Effects*, Royal Society of Chemistry. (Available via DIALOG, 1999), [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
 7. H. Ibach, H. Lüth, *Solid-State Physics*, 2nd edn. (Springer, New York, 1996), pp. 45–56
 8. S. Preuss, A. Demchuk Jr., M. Stuke, *Appl. Phys. A* **61**
 9. M.K. Slifka, J.L. Whitton, *J. Mol. Med.*, doi: 10.1007/s001090000086
 10. S.E. Smith, in *Neuromuscular Junction*, ed. by E. Zaimis. *Handbook of Experimental Pharmacology*, vol 42 (Springer, Heidelberg, 1976), p. 593
 11. Calfee, R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.
 12. Dod, J. (1999). Effective substances. In: *The dictionary of substances and their effects*. Royal Society of Chemistry. Available via DIALOG. [http://www.rsc.org/dose/Effective substances](http://www.rsc.org/dose/Effective%20substances). Cited 15 Jan 1999.
 13. Harris, M., Karper, E., Stacks, G., Hoffman, D., DeNiro, R., Cruz, P., et al. (2001). Writing labs and the Hollywood connection. *J Film Writing*, 44(3), 213–245.
 14. O’Neil, J. M., & Egan, J. (1992). Men’s and women’s gender role journeys: Metaphor for healing, transition, and transformation. In B. R. Wainrig (Ed.), *Gender issues across the life cycle* (pp. 107–123). New York: Springer.
 15. Kreger, M., Brindis, C.D., Manuel, D.M., Sassoubre, L. (2007). Lessons learned in systems change initiatives: benchmarks and indicators. *American Journal of Community Psychology*, doi: 10.1007/s10464-007-9108-14.

² Always use the standard abbreviation of a journal’s name according to the *ISSN List of Title Word Abbreviations*, see <http://www.issn.org/en/node/344>

16. Alber John, Daniel C. O'Connell, and Sabine Kowal. 2002. Personal perspective in TV interviews. *Pragmatics* 12:257–271
17. Cameron, Deborah. 1997. Theoretical debates in feminist linguistics: Questions of sex and gender. In *Gender and discourse*, ed. Ruth Wodak, 99–119. London: Sage Publications.
18. Cameron, Deborah. 1985. *Feminism and linguistic theory*. New York: St. Martin's Press.
19. Dod, Jake. 1999. Effective substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
<http://www.rsc.org/dose/title> of subordinate document. Cited 15 Jan 1999
20. Suleiman, Camelia, Daniel C. O'Connell, and Sabine Kowal. 2002. 'If you and I, if we, in this later day, lose that sacred fire...': Perspective in political interviews. *Journal of Psycholinguistic Research*. doi: 10.1023/A:1015592129296.
21. Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) The rise of modern genomics, 3rd edn. Wiley, New York
22. Dod J (1999) Effective Substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
<http://www.rsc.org/dose/title> of subordinate document. Cited 15 Jan 1999
23. Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. *J Mol Med*, doi: 10.1007/s001090000086
24. Smith J, Jones M Jr, Houghton L et al (1999) Future of health insurance. *N Engl J Med* 341:325–329
25. South J, Blass B (2001) The future of modern genomics. Blackwell, London

Chapter 6

System Evaluations

6.1 Offline Performance Metrics

6.2 Online Evaluations

6.2.1 Online Metrics

6.2.2 A/B Testing

6.2.3 Interleaving

References

In view of the parallel print and (chapter-wise) online publication of your book at www.springerlink.com it has been decided that – as a general rule – references should be sorted chapter-wise and placed at the end of the individual chapters. However, upon agreement with your contact at Springer you may list your references in a single separate chapter at the end of your book. Deactivate the class option `sectrefs` and the `thebibliography` environment will be put out as a chapter of its own.

References may be *cited* in the text either by number (preferred) or by author/year.¹ If the citation in the text is numbered, the reference list should be arranged in ascending order. If the citation in the text is author/year, the reference list should be *sorted* alphabetically and if there are several works by the same author, the following order should be used:

1. all works by the author alone, ordered chronologically by year of publication

¹ Make sure that all references from the list are cited in the text. Those not cited should be moved to a separate *Further Reading* section or chapter.

2. all works by the author with a coauthor, ordered alphabetically by coauthor
3. all works by the author with several coauthors, ordered chronologically by year of publication.

The *styling* of references² depends on the subject of your book:

- The *two* recommended styles for references in books on *mathematical, physical, statistical and computer sciences* are depicted in [1–5] and [6–10].
 - Examples of the most commonly used reference style in books on *Psychology, Social Sciences* are [11–15].
 - Examples for references in books on *Humanities, Linguistics, Philosophy* are [16–20].
 - Examples of the basic Springer style used in publications on a wide range of subjects such as *Computer Science, Economics, Engineering, Geosciences, Life Sciences, Medicine, Biomedicine* are [21–25].
1. Broy, M.: Software engineering — from auxiliary to key technologies. In: Broy, M., Dener, E. (eds.) *Software Pioneers*, pp. 10–13. Springer, Heidelberg (2002)
 2. Dod, J.: Effective substances. In: *The Dictionary of Substances and Their Effects*. Royal Society of Chemistry (1999) Available via DIALOG. [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
 3. Geddes, K.O., Czapor, S.R., Labahn, G.: *Algorithms for Computer Algebra*. Kluwer, Boston (1992)
 4. Hamburger, C.: Quasimonotonicity, regularity and duality for nonlinear systems of partial differential equations. *Ann. Mat. Pura. Appl.* **169**, 321–354 (1995)
 5. Slifka, M.K., Whitton, J.L.: Clinical implications of dysregulated cytokine production. *J. Mol. Med.* (2000) doi: 10.1007/s001090000086
 6. J. Dod, in *The Dictionary of Substances and Their Effects*, Royal Society of Chemistry. (Available via DIALOG, 1999), [http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
 7. H. Ibach, H. Lüth, *Solid-State Physics*, 2nd edn. (Springer, New York, 1996), pp. 45–56
 8. S. Preuss, A. Demchuk Jr., M. Stuke, *Appl. Phys. A* **61**
 9. M.K. Slifka, J.L. Whitton, *J. Mol. Med.*, doi: 10.1007/s001090000086
 10. S.E. Smith, in *Neuromuscular Junction*, ed. by E. Zaimis. *Handbook of Experimental Pharmacology*, vol 42 (Springer, Heidelberg, 1976), p. 593
 11. Calfee, R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.
 12. Dod, J. (1999). Effective substances. In: *The dictionary of substances and their effects*. Royal Society of Chemistry. Available via DIALOG. [http://www.rsc.org/dose/Effective substances](http://www.rsc.org/dose/Effective%20substances). Cited 15 Jan 1999.
 13. Harris, M., Karper, E., Stacks, G., Hoffman, D., DeNiro, R., Cruz, P., et al. (2001). Writing labs and the Hollywood connection. *J Film Writing*, 44(3), 213–245.
 14. O’Neil, J. M., & Egan, J. (1992). Men’s and women’s gender role journeys: Metaphor for healing, transition, and transformation. In B. R. Wainrig (Ed.), *Gender issues across the life cycle* (pp. 107–123). New York: Springer.
 15. Kreger, M., Brindis, C.D., Manuel, D.M., Sassoubre, L. (2007). Lessons learned in systems change initiatives: benchmarks and indicators. *American Journal of Community Psychology*, doi: 10.1007/s10464-007-9108-14.

² Always use the standard abbreviation of a journal’s name according to the *ISSN List of Title Word Abbreviations*, see <http://www.issn.org/en/node/344>

16. Alber John, Daniel C. O'Connell, and Sabine Kowal. 2002. Personal perspective in TV interviews. *Pragmatics* 12:257–271
17. Cameron, Deborah. 1997. Theoretical debates in feminist linguistics: Questions of sex and gender. In *Gender and discourse*, ed. Ruth Wodak, 99–119. London: Sage Publications.
18. Cameron, Deborah. 1985. *Feminism and linguistic theory*. New York: St. Martin's Press.
19. Dod, Jake. 1999. Effective substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
<http://www.rsc.org/dose/title> of subordinate document. Cited 15 Jan 1999
20. Suleiman, Camelia, Daniel C. O'Connell, and Sabine Kowal. 2002. 'If you and I, if we, in this later day, lose that sacred fire...': Perspective in political interviews. *Journal of Psycholinguistic Research*. doi: 10.1023/A:1015592129296.
21. Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) The rise of modern genomics, 3rd edn. Wiley, New York
22. Dod J (1999) Effective Substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
<http://www.rsc.org/dose/title> of subordinate document. Cited 15 Jan 1999
23. Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. *J Mol Med*, doi: 10.1007/s001090000086
24. Smith J, Jones M Jr, Houghton L et al (1999) Future of health insurance. *N Engl J Med* 341:325–329
25. South J, Blass B (2001) The future of modern genomics. Blackwell, London

Chapter 7

Advanced Topics

7.1 Context Sensitivity

7.2 Time and Location Sensitivity

7.3 Sociality and Trust

7.4 Attack Resistance

7.5 Fair Recommendation

7.6 Privacy Preservation

7.7 Personalization

References

In view of the parallel print and (chapter-wise) online publication of your book at www.springerlink.com it has been decided that – as a general rule – references should be sorted chapter-wise and placed at the end of the individual chapters. However, upon agreement with your contact at Springer you may list your references in a single separate chapter at the end of your book. Deactivate the class option `sectrefs` and the `thebibliography` environment will be put out as a chapter of its own.

References may be *cited* in the text either by number (preferred) or by author/year.¹

¹ Make sure that all references from the list are cited in the text. Those not cited should be moved to a separate *Further Reading* section or chapter.

If the citation in the text is numbered, the reference list should be arranged in ascending order. If the citation in the text is author/year, the reference list should be *sorted* alphabetically and if there are several works by the same author, the following order should be used:

1. all works by the author alone, ordered chronologically by year of publication
2. all works by the author with a coauthor, ordered alphabetically by coauthor
3. all works by the author with several coauthors, ordered chronologically by year of publication.

The *styling* of references² depends on the subject of your book:

- The *two* recommended styles for references in books on *mathematical, physical, statistical and computer sciences* are depicted in [1–5] and [6–10].
 - Examples of the most commonly used reference style in books on *Psychology, Social Sciences* are [11–15].
 - Examples for references in books on *Humanities, Linguistics, Philosophy* are [16–20].
 - Examples of the basic Springer style used in publications on a wide range of subjects such as *Computer Science, Economics, Engineering, Geosciences, Life Sciences, Medicine, Biomedicine* are [21–25].
1. Broy, M.: Software engineering — from auxiliary to key technologies. In: Broy, M., Dener, E. (eds.) *Software Pioneers*, pp. 10–13. Springer, Heidelberg (2002)
 2. Dod, J.: Effective substances. In: *The Dictionary of Substances and Their Effects*. Royal Society of Chemistry (1999) Available via DIALOG. <http://www.rsc.org/dose/title of subordinate document>. Cited 15 Jan 1999
 3. Geddes, K.O., Czapor, S.R., Labahn, G.: *Algorithms for Computer Algebra*. Kluwer, Boston (1992)
 4. Hamburger, C.: Quasimonotonicity, regularity and duality for nonlinear systems of partial differential equations. *Ann. Mat. Pura. Appl.* **169**, 321–354 (1995)
 5. Slifka, M.K., Whitton, J.L.: Clinical implications of dysregulated cytokine production. *J. Mol. Med.* (2000) doi: 10.1007/s001090000086
 6. J. Dod, in *The Dictionary of Substances and Their Effects*, Royal Society of Chemistry. (Available via DIALOG, 1999), <http://www.rsc.org/dose/title of subordinate document>. Cited 15 Jan 1999
 7. H. Ibach, H. Lüth, *Solid-State Physics*, 2nd edn. (Springer, New York, 1996), pp. 45–56
 8. S. Preuss, A. Demchuk Jr., M. Stuke, *Appl. Phys. A* **61**
 9. M.K. Slifka, J.L. Whitton, *J. Mol. Med.*, doi: 10.1007/s001090000086
 10. S.E. Smith, in *Neuromuscular Junction*, ed. by E. Zaimis. *Handbook of Experimental Pharmacology*, vol 42 (Springer, Heidelberg, 1976), p. 593
 11. Calfee, R. C., & Valencia, R. R. (1991). *APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.
 12. Dod, J. (1999). Effective substances. In: *The dictionary of substances and their effects*. Royal Society of Chemistry. Available via DIALOG. <http://www.rsc.org/dose/Effective substances>. Cited 15 Jan 1999.

² Always use the standard abbreviation of a journal's name according to the *ISSN List of Title Word Abbreviations*, see <http://www.issn.org/en/node/344>

13. Harris, M., Karper, E., Stacks, G., Hoffman, D., DeNiro, R., Cruz, P., et al. (2001). Writing labs and the Hollywood connection. *J Film Writing*, 44(3), 213–245.
14. O’Neil, J. M., & Egan, J. (1992). Men’s and women’s gender role journeys: Metaphor for healing, transition, and transformation. In B. R. Wainrig (Ed.), *Gender issues across the life cycle* (pp. 107–123). New York: Springer.
15. Kreger, M., Brindis, C.D., Manuel, D.M., Sassoubre, L. (2007). Lessons learned in systems change initiatives: benchmarks and indicators. *American Journal of Community Psychology*, doi: 10.1007/s10464-007-9108-14.
16. Alber John, Daniel C. O’Connell, and Sabine Kowal. 2002. Personal perspective in TV interviews. *Pragmatics* 12:257–271
17. Cameron, Deborah. 1997. Theoretical debates in feminist linguistics: Questions of sex and gender. In *Gender and discourse*, ed. Ruth Wodak, 99–119. London: Sage Publications.
18. Cameron, Deborah. 1985. *Feminism and linguistic theory*. New York: St. Martin’s Press.
19. Dod, Jake. 1999. Effective substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
[http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
20. Suleiman, Camelia, Daniel C. O’Connell, and Sabine Kowal. 2002. ‘If you and I, if we, in this later day, lose that sacred fire...’: Perspective in political interviews. *Journal of Psycholinguistic Research*. doi: 10.1023/A:1015592129296.
21. Brown B, Aaron M (2001) The politics of nature. In: Smith J (ed) The rise of modern genomics, 3rd edn. Wiley, New York
22. Dod J (1999) Effective Substances. In: The dictionary of substances and their effects. Royal Society of Chemistry. Available via DIALOG.
[http://www.rsc.org/dose/title of subordinate document](http://www.rsc.org/dose/title%20of%20subordinate%20document). Cited 15 Jan 1999
23. Slifka MK, Whitton JL (2000) Clinical implications of dysregulated cytokine production. *J Mol Med*, doi: 10.1007/s001090000086
24. Smith J, Jones M Jr, Houghton L et al (1999) Future of health insurance. *N Engl J Med* 341:325–329
25. South J, Blass B (2001) The future of modern genomics. Blackwell, London

Appendix A

Appendix

All's well that ends well

A.1 Math Appendix

Glossary

Use the template *glossary.tex* together with the Springer document class SVMono (monograph-type books) or SVMult (edited books) to style your glossary in the Springer layout.

glossary term Write here the description of the glossary term. Write here the description of the glossary term. Write here the description of the glossary term.

glossary term Write here the description of the glossary term. Write here the description of the glossary term. Write here the description of the glossary term.

glossary term Write here the description of the glossary term. Write here the description of the glossary term. Write here the description of the glossary term.

glossary term Write here the description of the glossary term. Write here the description of the glossary term. Write here the description of the glossary term.

glossary term Write here the description of the glossary term. Write here the description of the glossary term. Write here the description of the glossary term.

Index

acronyms, list of, vii

glossary, 29

symbols, list of, vii