Appendix A Matrix multiplication

The multiplication of a matrix by another matrix is illustrated in Figure A.1. In this case, the matrix has been multiplied by a copy of itself that has been flipped along its diagonal (this new matrix is called the transpose of the original matrix).

Each entry in the multiplied matrix is the sum of values in the cell's row in the original matrix multiplied by the values in the cell's column in the transpose of the matrix. For example, the value 251 (top-left cell) in the multiplied matrix is obtained from:

$$(1\times1)+(5\times5)+(9\times9)+(12\times12)=1+25+81+144=251$$

As another example, the value 309 (second row from the top, second column) of the multiplied matrix is obtained from:

$$(2\times2)+(6\times6)+(10\times10)+(13\times13)=4+36+100+169=309$$

The cells used in this example are highlighted in Figure A.2.

1	5	9	12
2	6	10	13
3	7	11	14
4	8	12	15

Original matrix

x

1	2	3	4
5	6	7	8
9	10	11	12
12	13	14	15

Flipped matrix (transpose)

=

251	278	305	332
278	309	340	371
305	340	375	410
332	371	410	449

Multiplied matrix

Figure A.1 Matrix multiplication.

1	5	9	12
2	**6**	**10**	**13**
3	7	11	14
4	8	12	15

Original matrix

x

1	**2**	3	4
5	**6**	7	8
9	**10**	11	12
12	**13**	14	15

Flipped matrix (transpose)

=

251	278	305	332
278	**309**	340	371
305	340	375	410
332	371	410	449

Multiplied matrix

Figure A.2 Matrix multiplication: selection of cells for the output cell in column 2, row 2.