Module 5.3 : Contours

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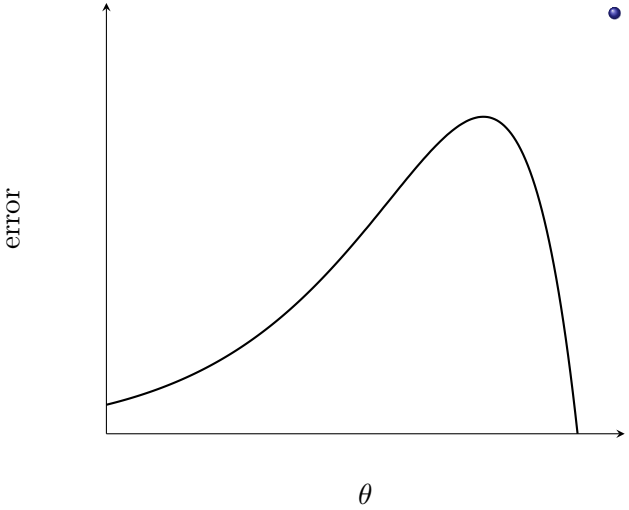
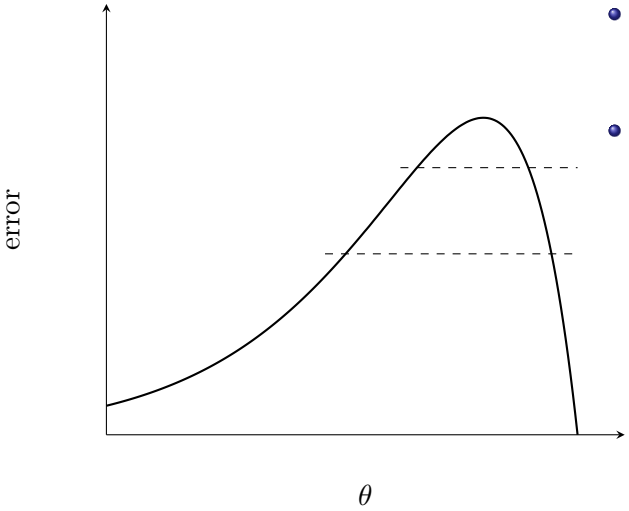
- *Can we do a 2d visualization of this traversal along the error surface*
- *Yes, let's take a look at something known as contours*



- Suppose I take horizontal slices of this error surface at regular intervals along the vertical axis

Figure : Front view of a 3d error surface



- Suppose I take horizontal slices of this error surface at regular intervals along the vertical axis
- How would this look from the top-view ?

Figure : Front view of a 3d error surface

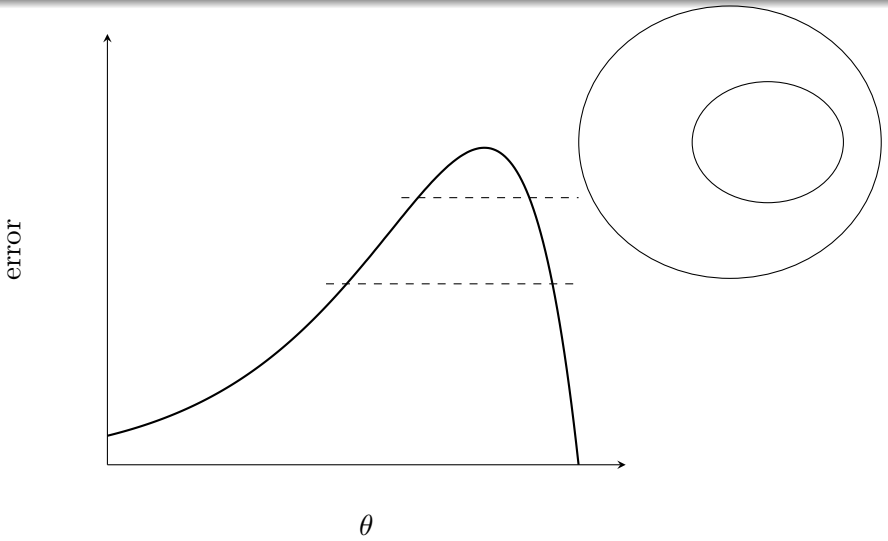
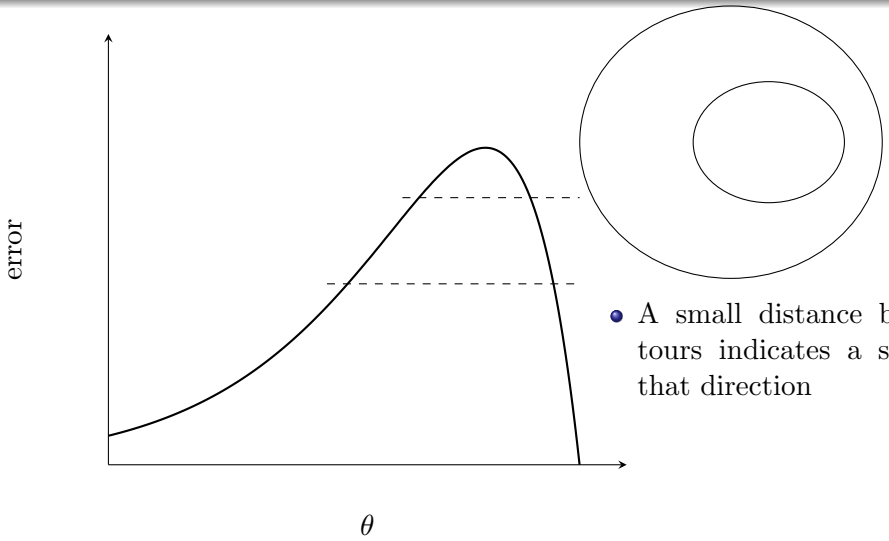
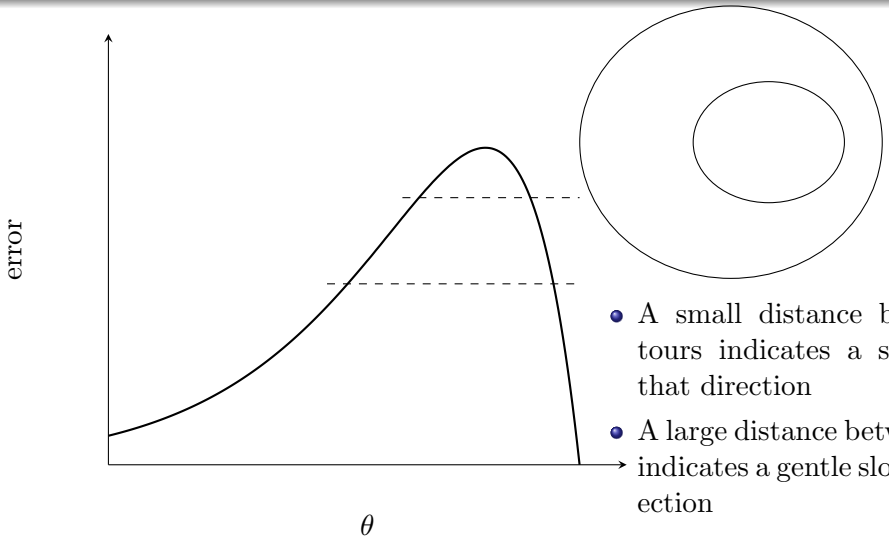


Figure : Front view of a 3d error surface



- A small distance between the contours indicates a steep slope along that direction

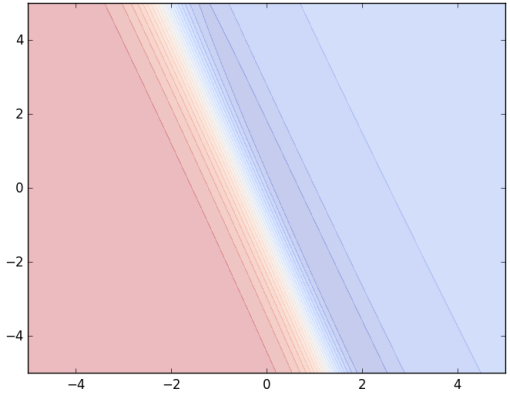
Figure : Front view of a 3d error surface



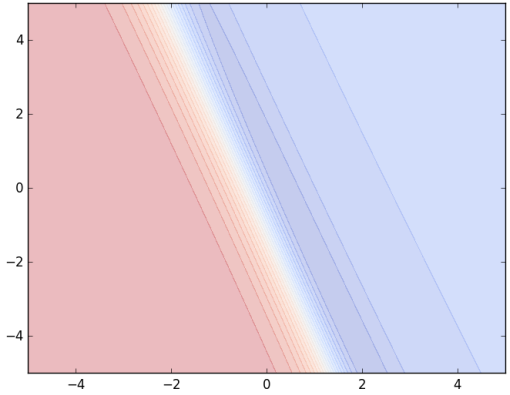
- A small distance between the contours indicates a steep slope along that direction
- A large distance between the contours indicates a gentle slope along that direction

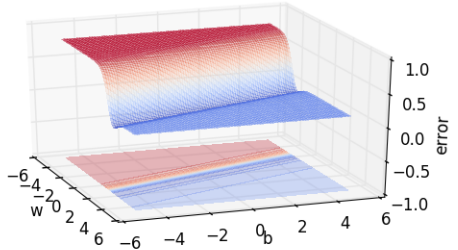
Figure : Front view of a 3d error surface

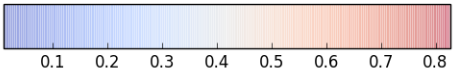
- *Just to ensure that we understand this properly let us do a few exercises ...*



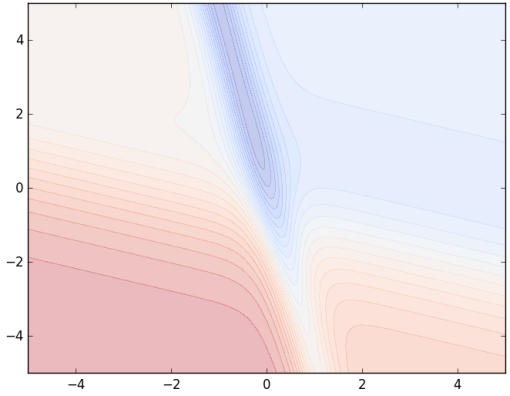
Guess the 3d surface



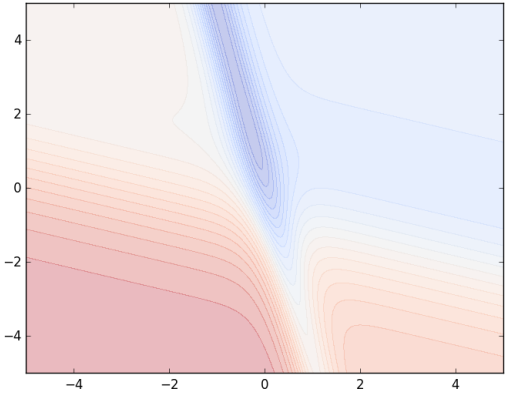


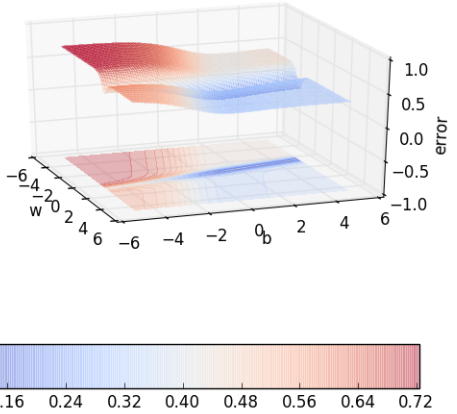


Guess the 3d surface

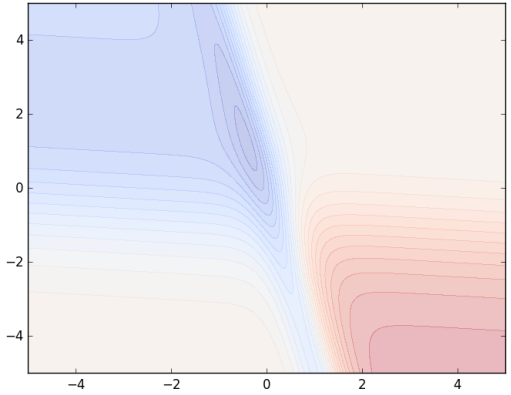


Guess the 3d surface

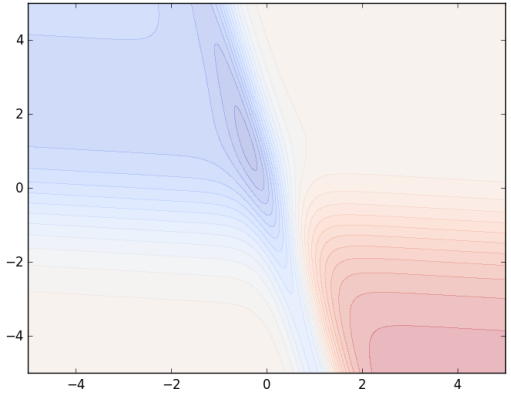


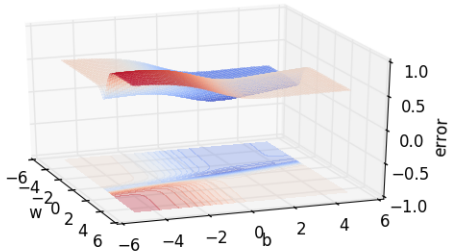


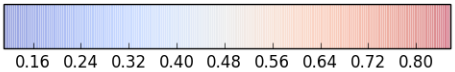
Guess the 3d surface



Guess the 3d surface

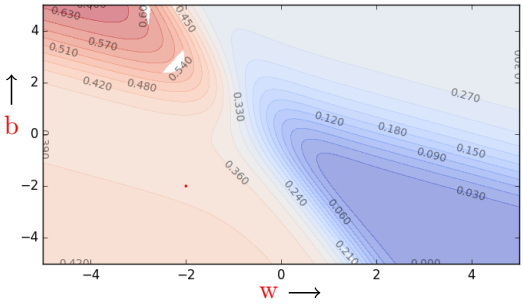




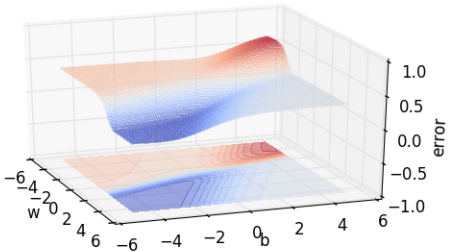


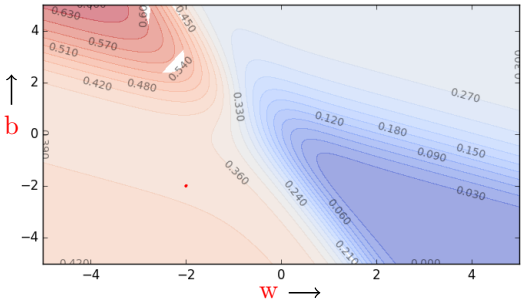
Guess the 3d surface

- *Now that we know what are contour maps and how to read them let us go back to our toy example and visualize gradient descent from the point of view of contours...*

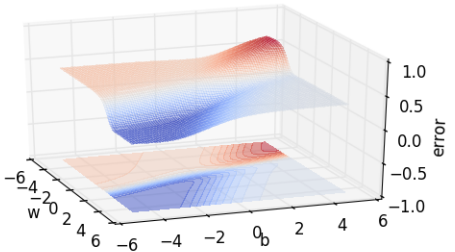


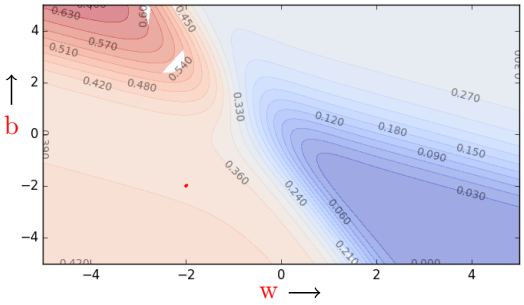
Gradient descent on the error surface



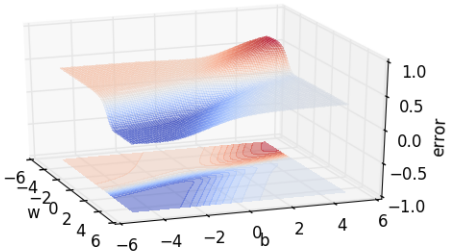


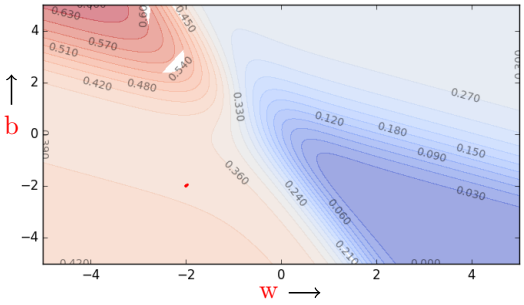
Gradient descent on the error surface



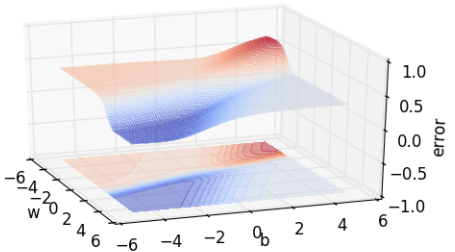


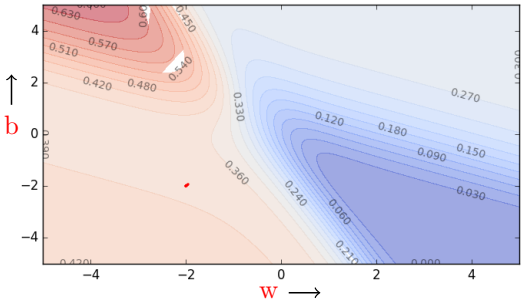
Gradient descent on the error surface



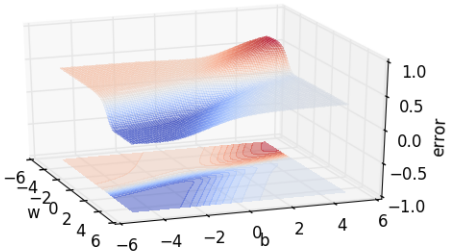


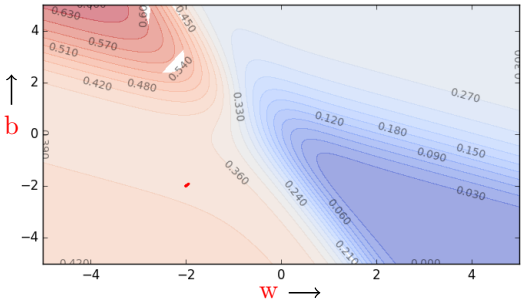
Gradient descent on the error surface



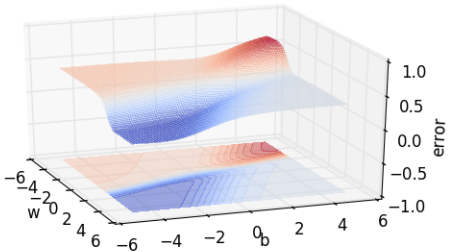


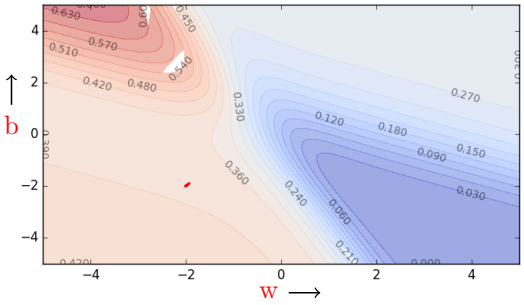
Gradient descent on the error surface



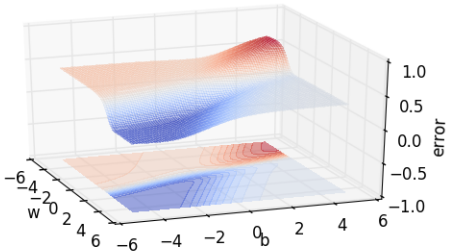


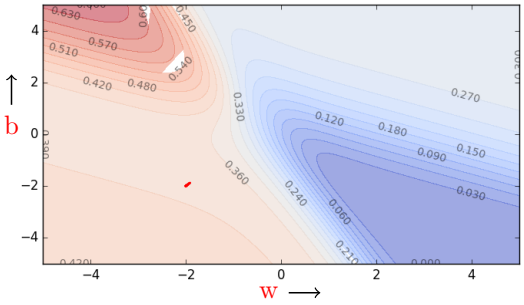
Gradient descent on the error surface



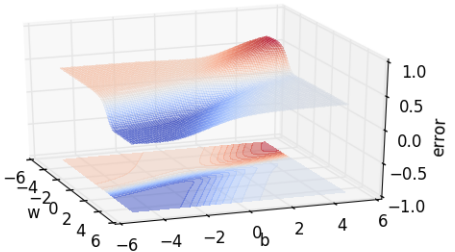


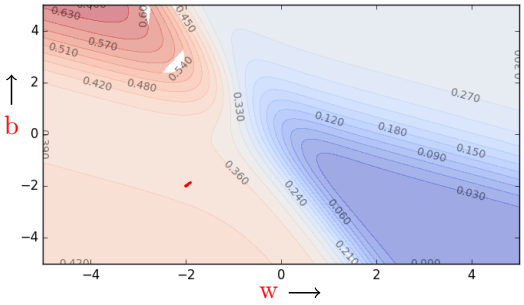
Gradient descent on the error surface



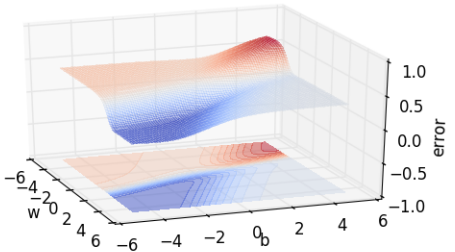


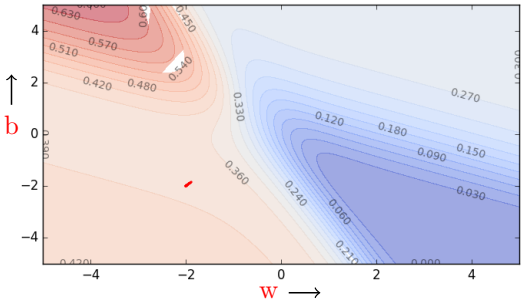
Gradient descent on the error surface





Gradient descent on the error surface

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0.420
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0.540
0.450
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0.270
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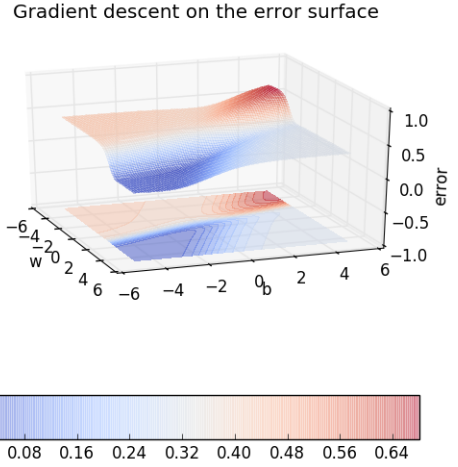
0.180
0.090
0.150
0.030
0.240
0.060
0.00 0.09 0.18 0.27 0.36 0.45 0.54 0.63


Gradient descent on the error surface
error
w
b
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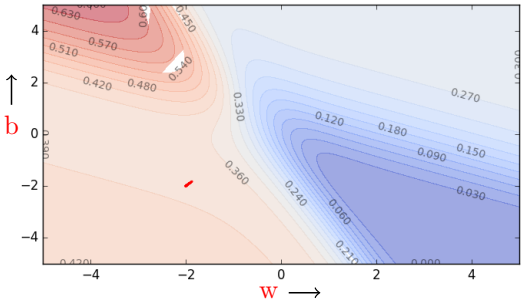
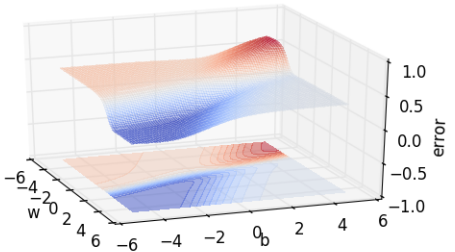
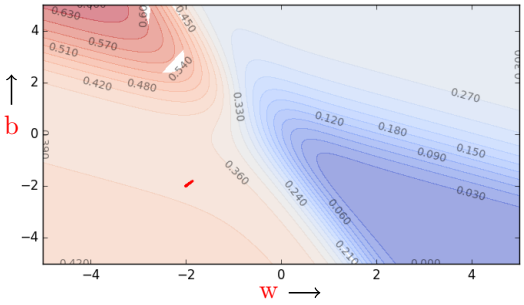
0.5
0.0
−0.5
−1.0
0.08 0.16 0.24 0.32 0.40 0.48 0.56 0.64

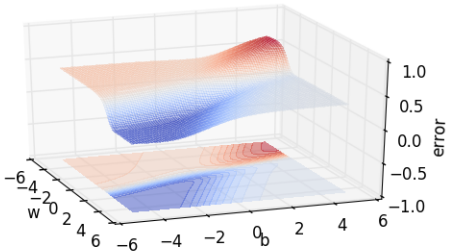


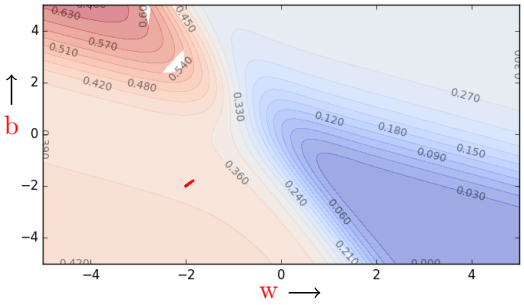
Gradient descent on the error surface



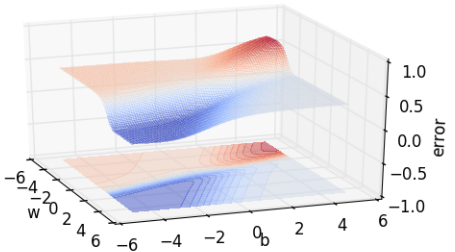


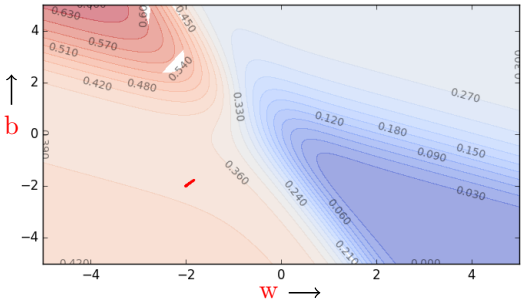
Gradient descent on the error surface



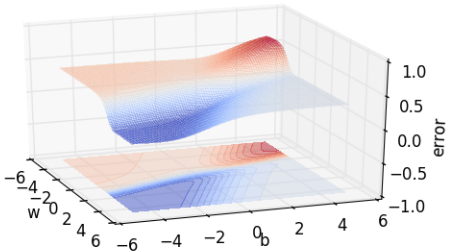


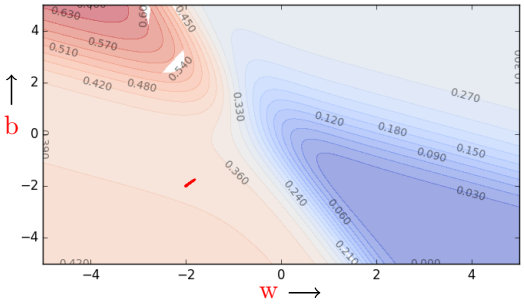
Gradient descent on the error surface



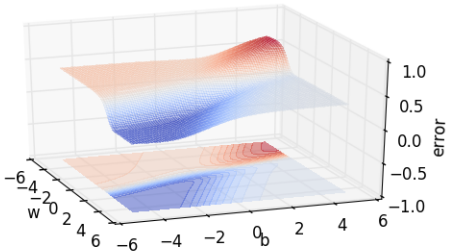


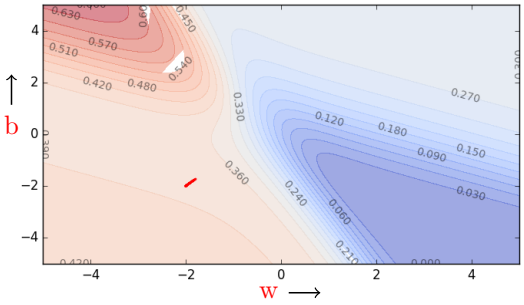
Gradient descent on the error surface



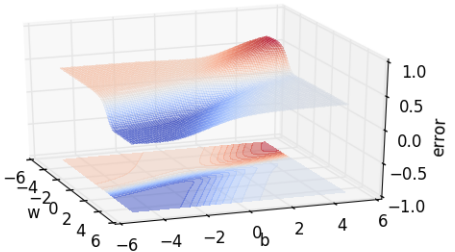


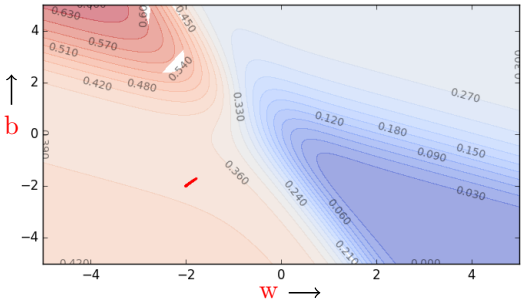
Gradient descent on the error surface

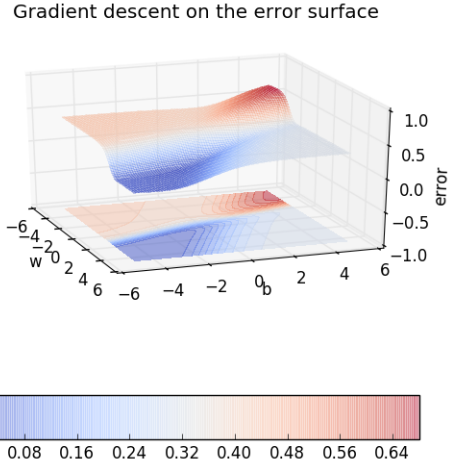


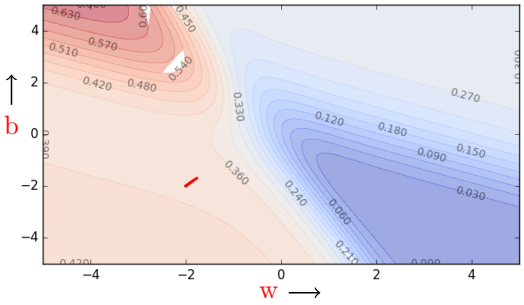


Gradient descent on the error surface

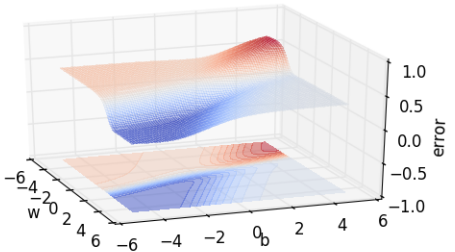


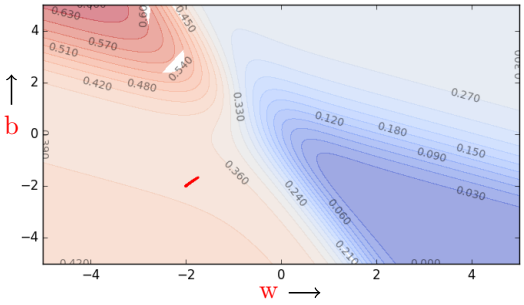

b
w
0.630
0.570
0.510
0.420
0.480
0.540
0.450
0.330
0.360
0.270
0.120
0.180
0.090
0.150
0.030
0.240
0.060
0.00 0.09 0.18 0.27 0.36 0.45 0.54 0.63


Gradient descent on the error surface
error
w
b
1.0
0.5
0.0
−0.5
−1.0
0.08 0.16 0.24 0.32 0.40 0.48 0.56 0.64

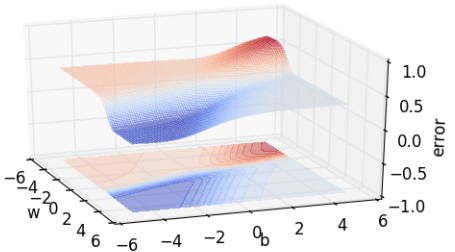


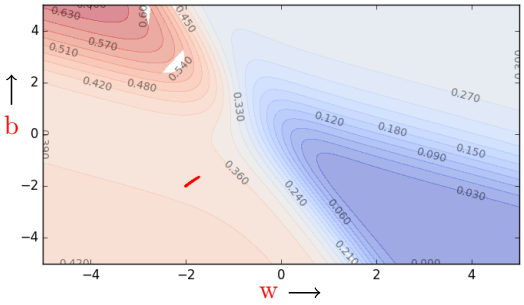
Gradient descent on the error surface



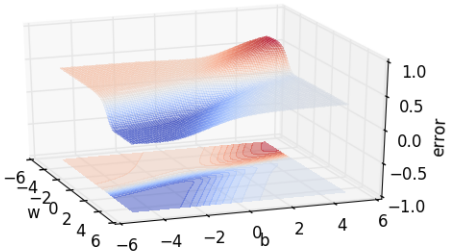


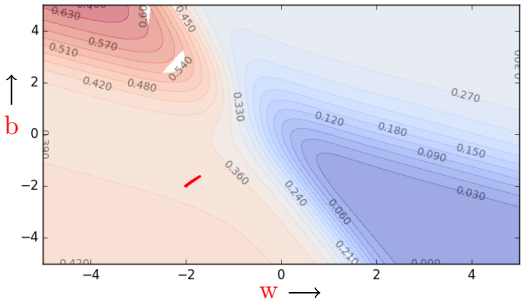
Gradient descent on the error surface



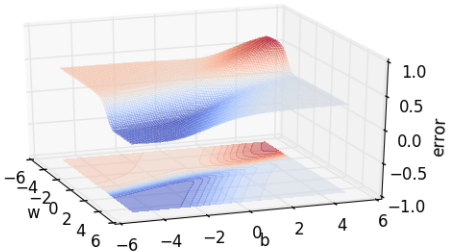


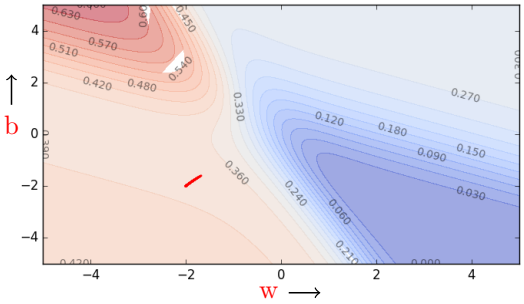
Gradient descent on the error surface



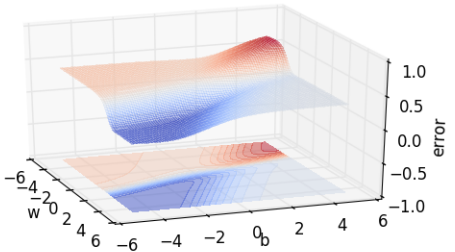


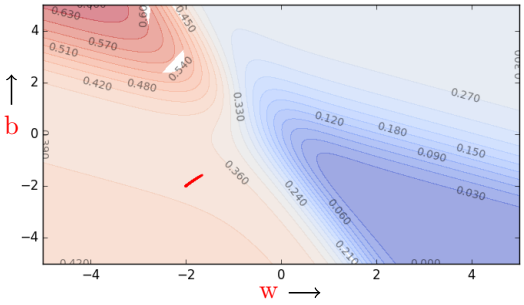
Gradient descent on the error surface



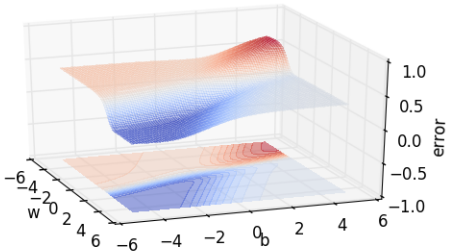


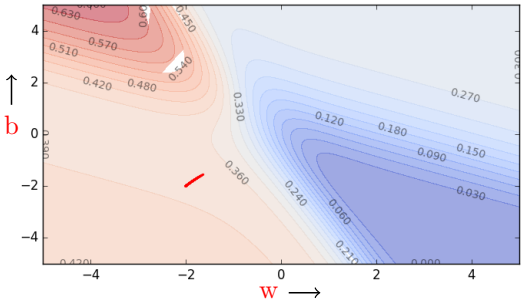
Gradient descent on the error surface



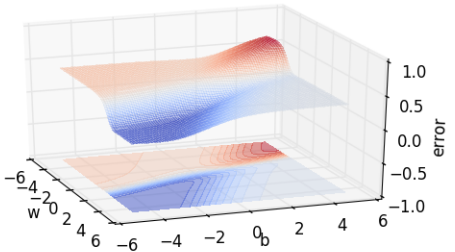


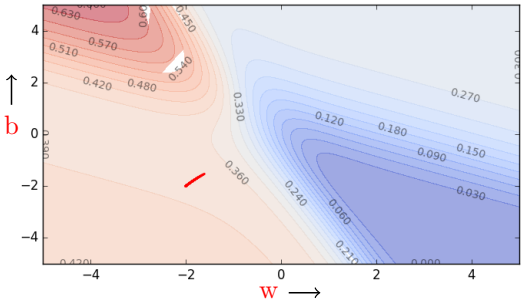
Gradient descent on the error surface



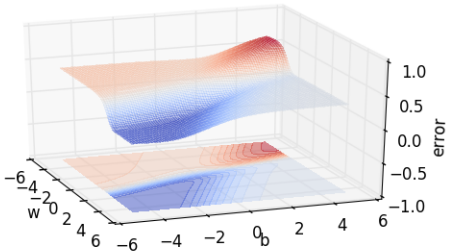


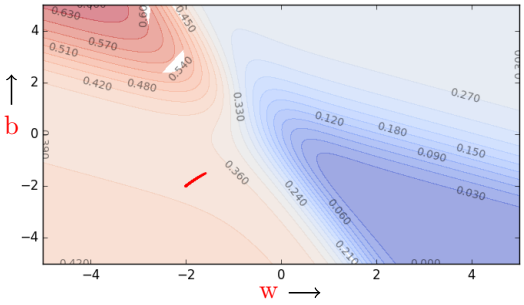
Gradient descent on the error surface



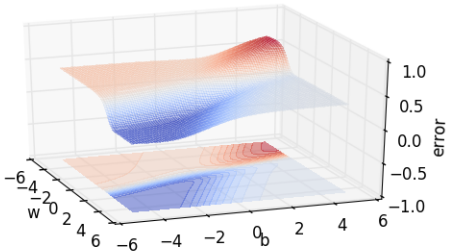


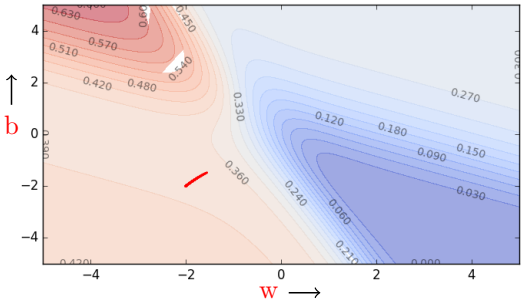
Gradient descent on the error surface



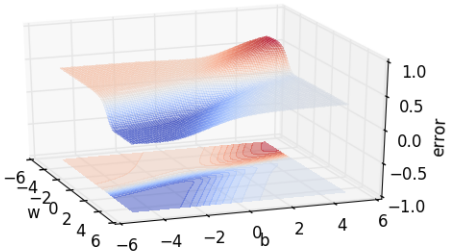


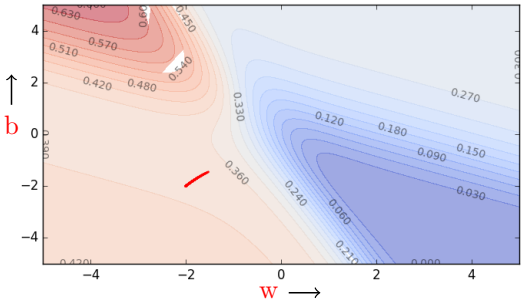
Gradient descent on the error surface





Gradient descent on the error surface





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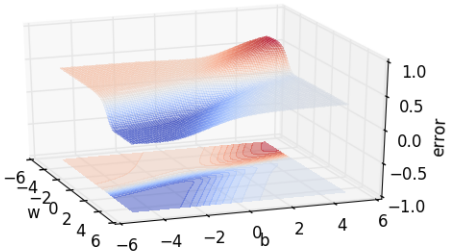

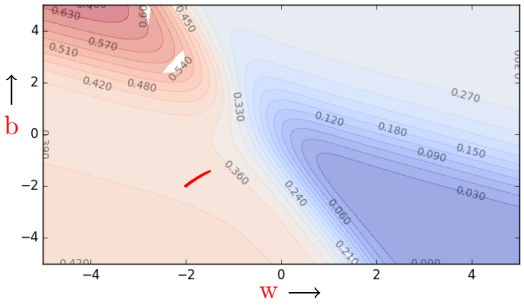

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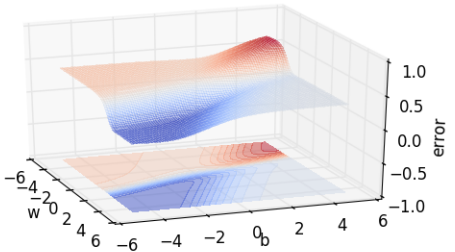
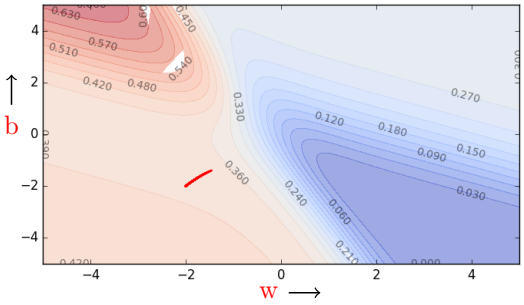
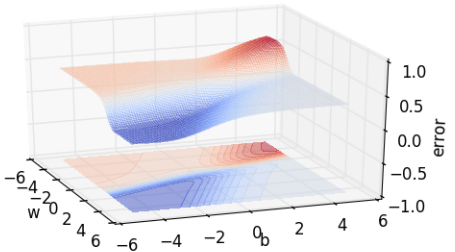
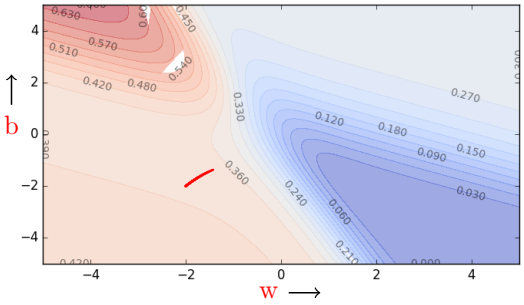


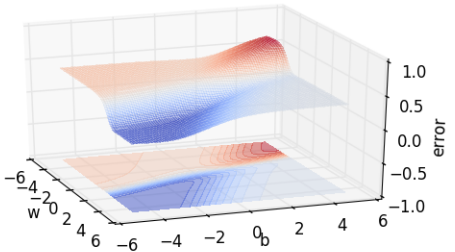


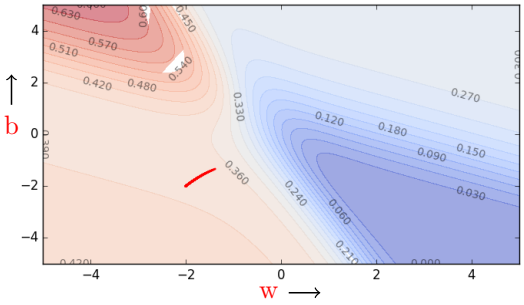
Gradient descent on the error surface



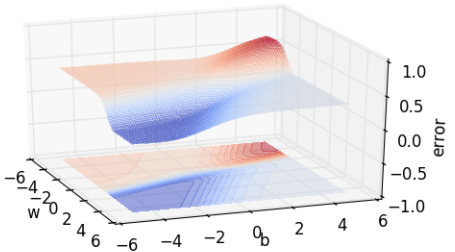


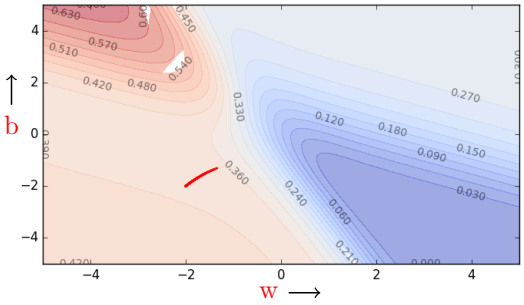
Gradient descent on the error surface



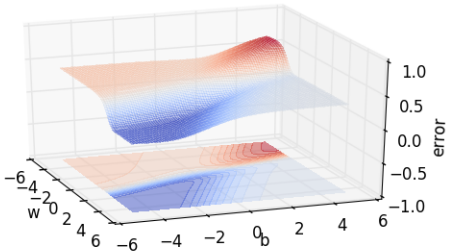


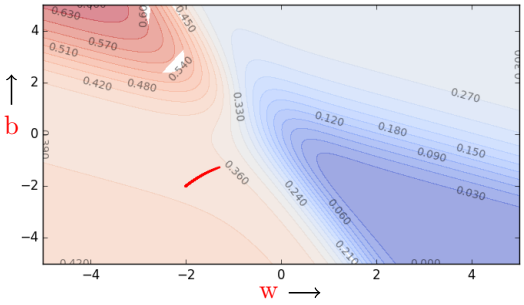
Gradient descent on the error surface



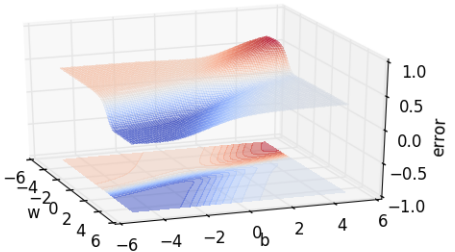


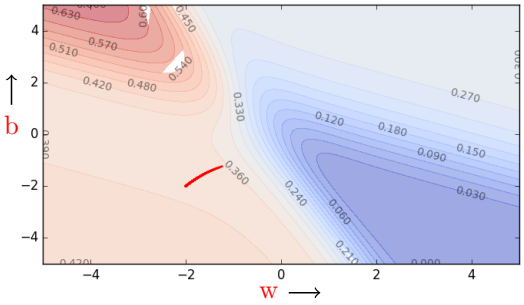
Gradient descent on the error surface



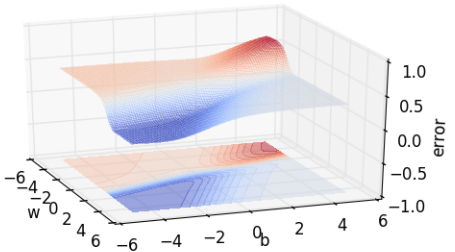


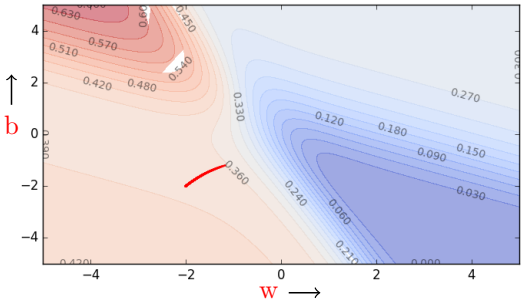
Gradient descent on the error surface



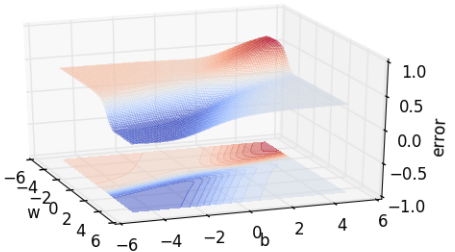


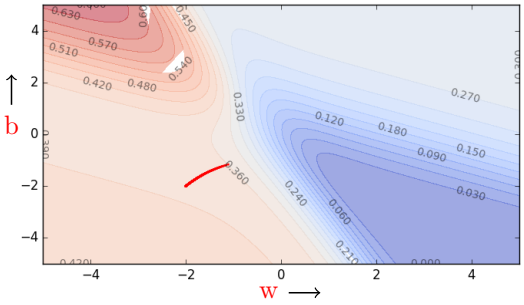
Gradient descent on the error surface



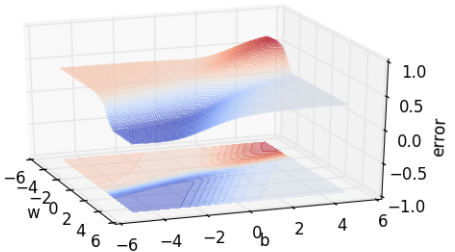


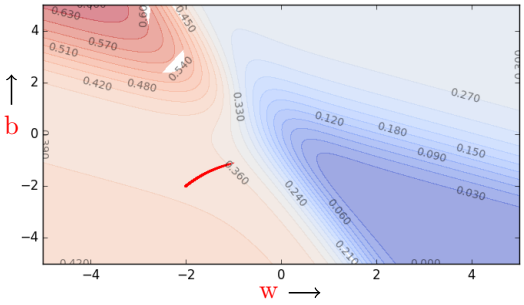
Gradient descent on the error surface



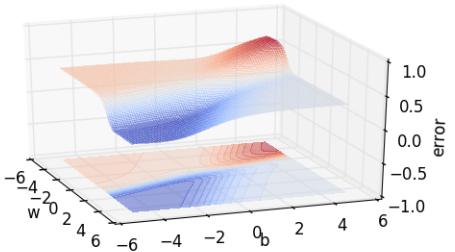


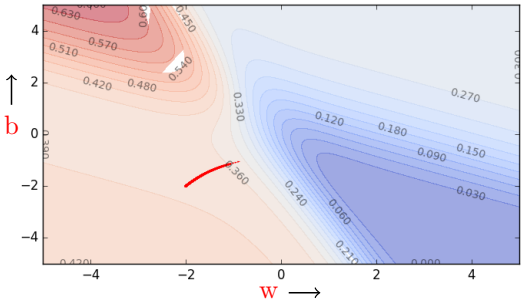
Gradient descent on the error surface



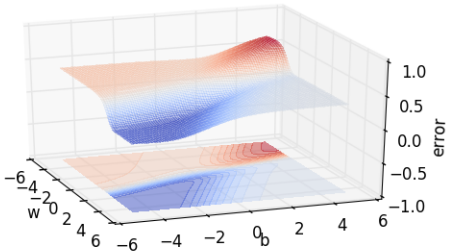


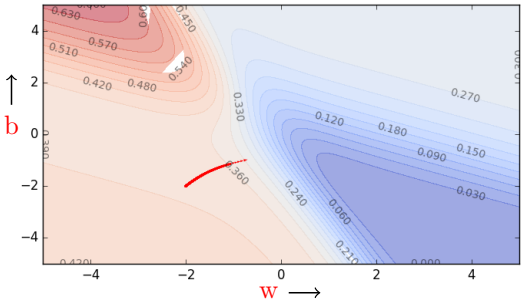
Gradient descent on the error surface



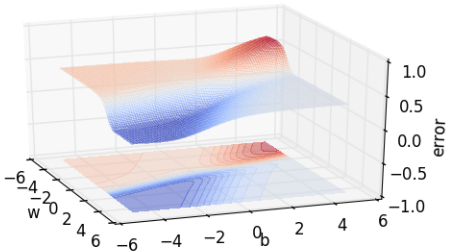


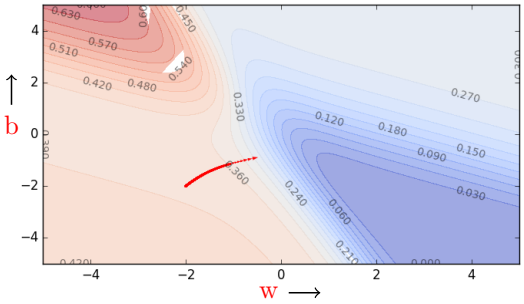
Gradient descent on the error surface



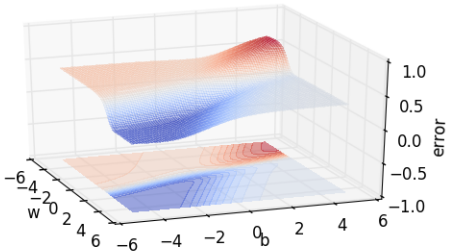


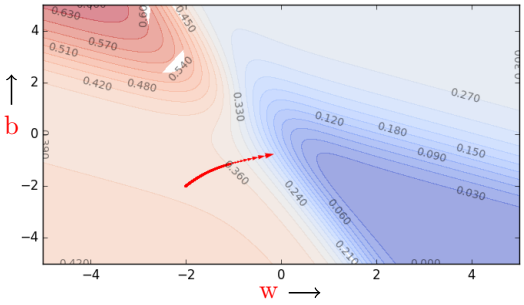
Gradient descent on the error surface





Gradient descent on the error surface





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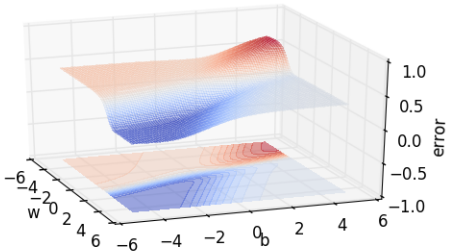

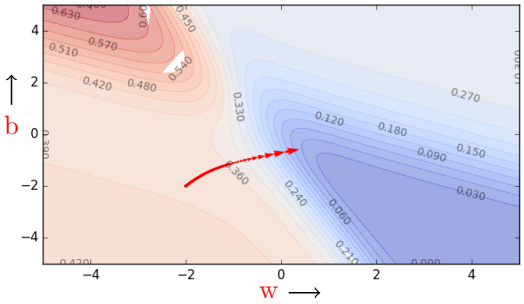

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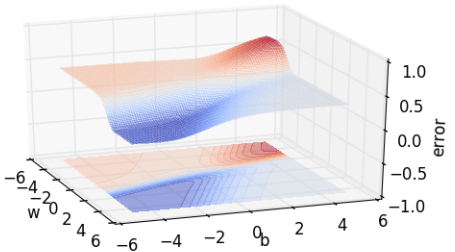

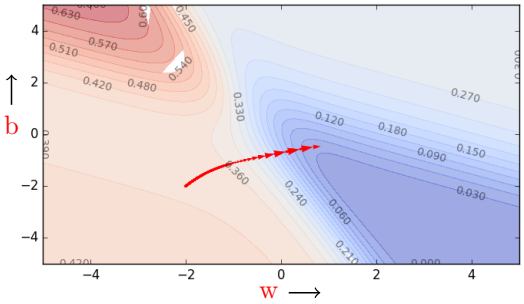

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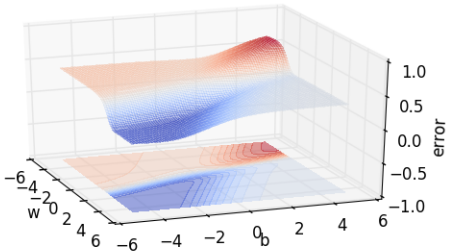

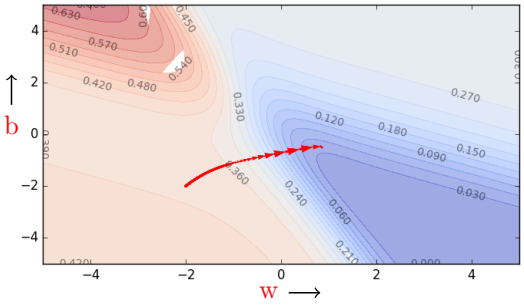

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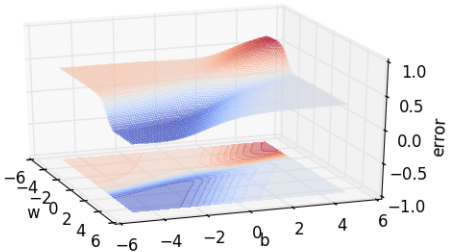

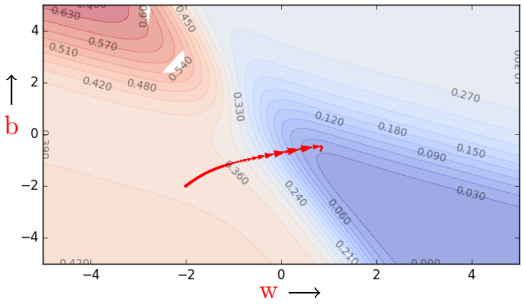

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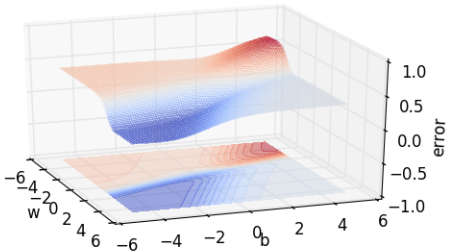

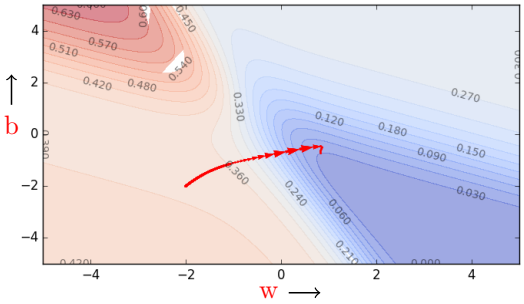

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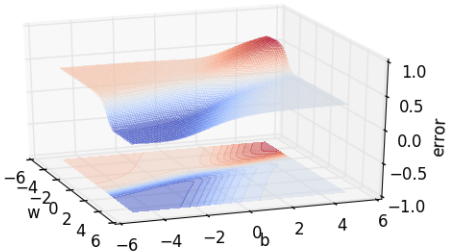
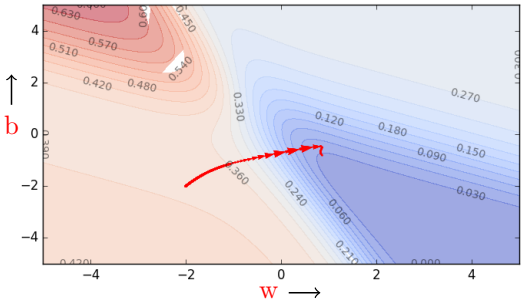
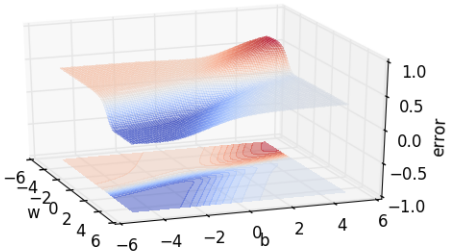
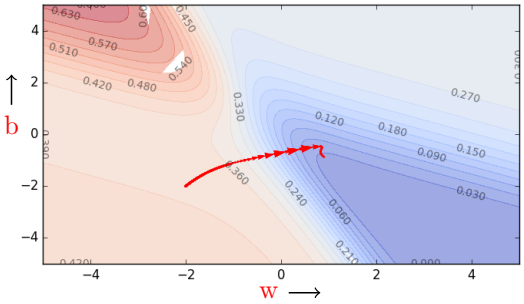




Gradient descent on the error surface





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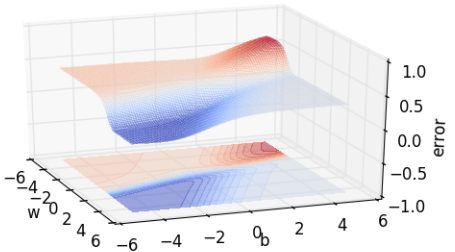

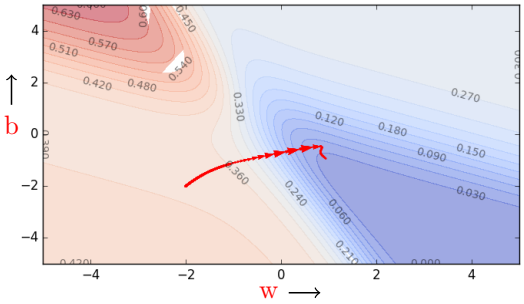

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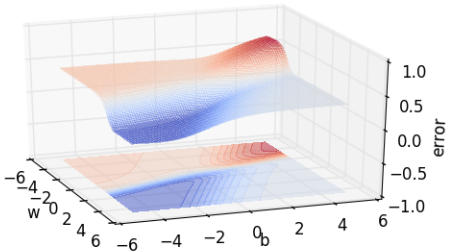
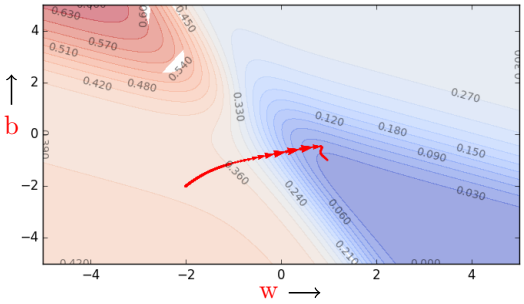
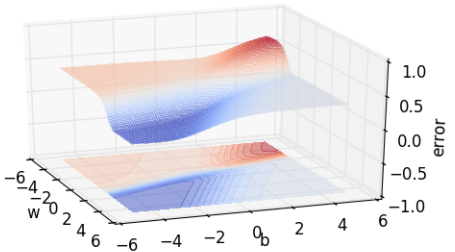
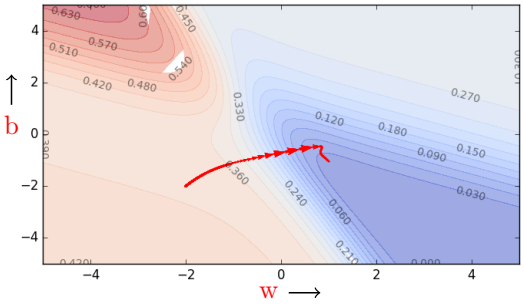




Gradient descent on the error surface





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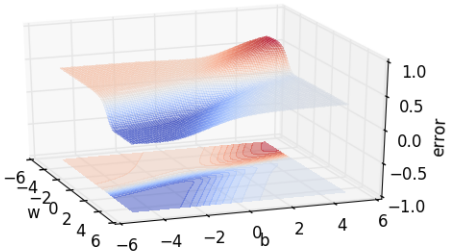

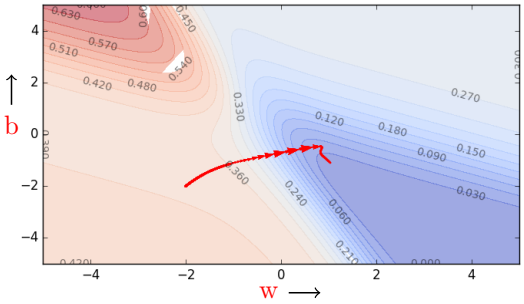

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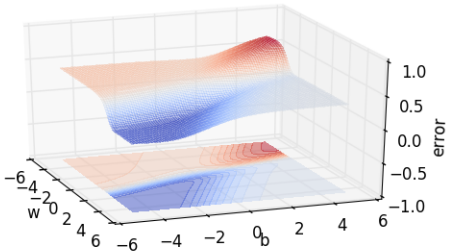

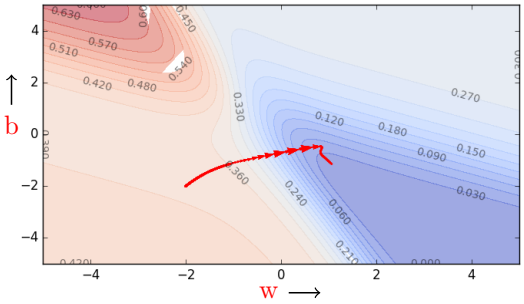

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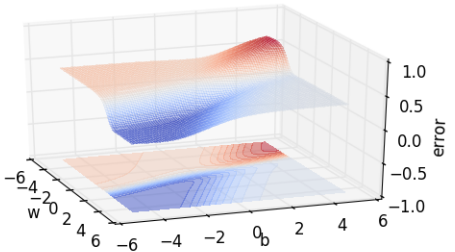

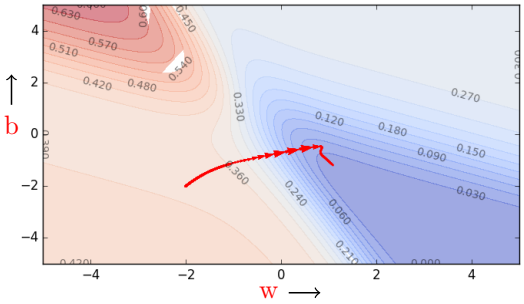

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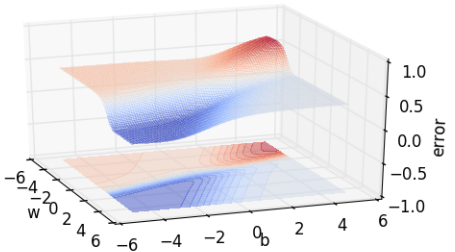

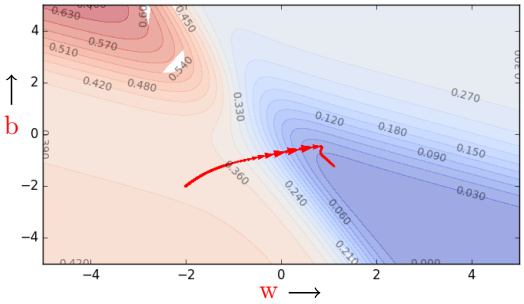

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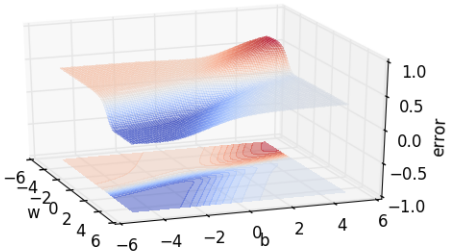

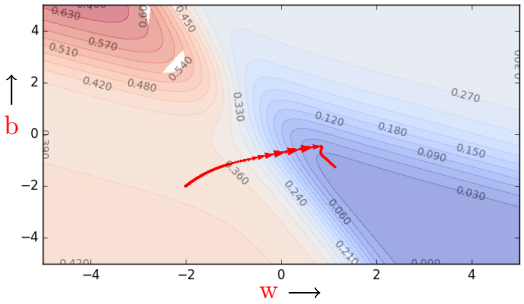

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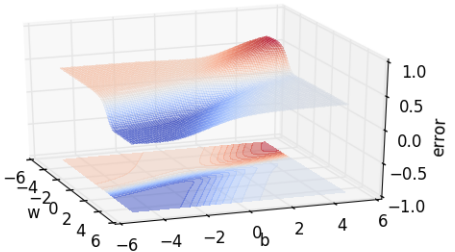

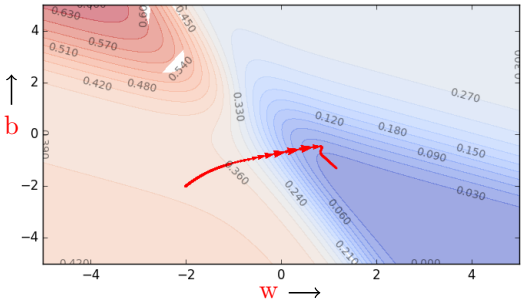

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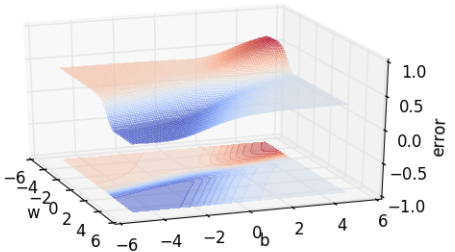
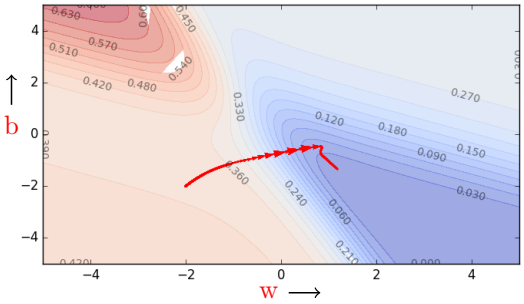
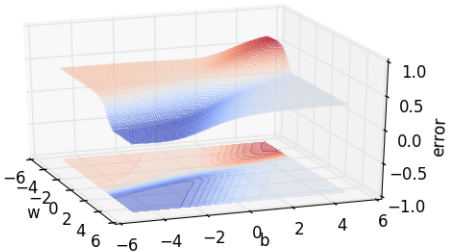
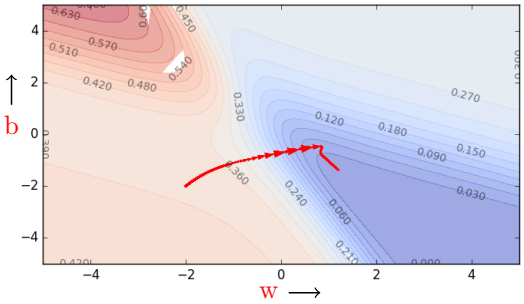


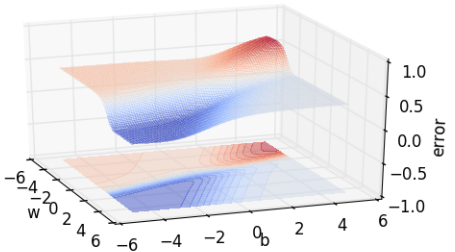


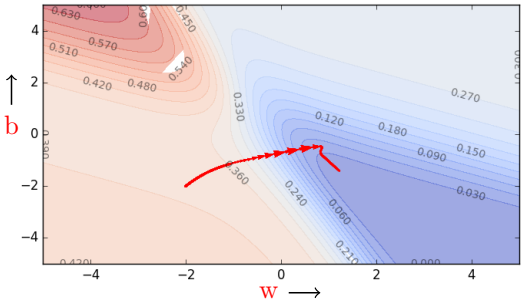
Gradient descent on the error surface



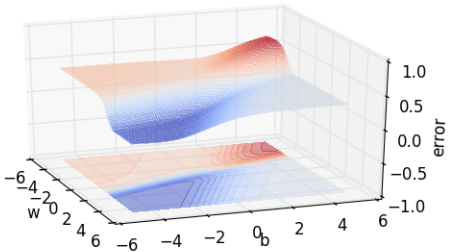


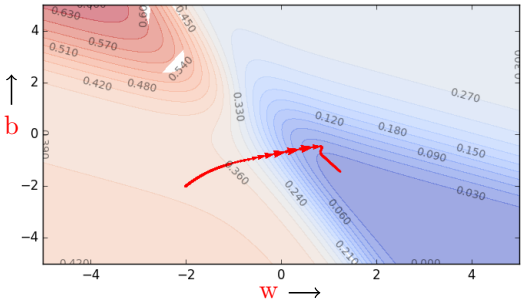
Gradient descent on the error surface



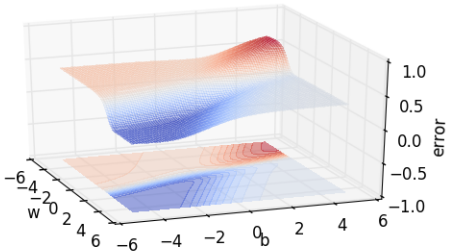


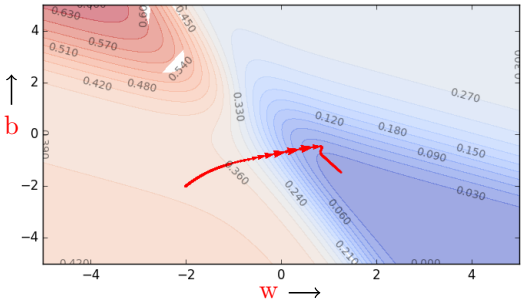
Gradient descent on the error surface





Gradient descent on the error surface




b
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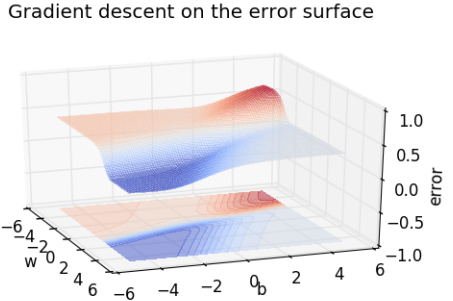
0.510
0.420
0.480
0.540
0.450
0.330
0.270
0.120
0.180
0.090
0.150
0.030
0.360
0.240
0.060
0.210
0.300
0.390
0.420
4
2
0
−2
−4
−4
−2
0
2
4
0.00 0.09 0.18 0.27 0.36 0.45 0.54 0.63


Gradient descent on the error surface
error
w
b
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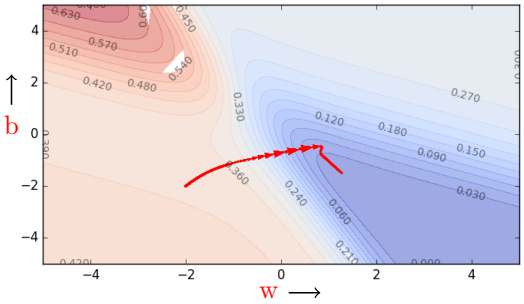
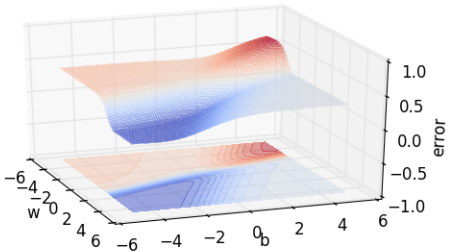
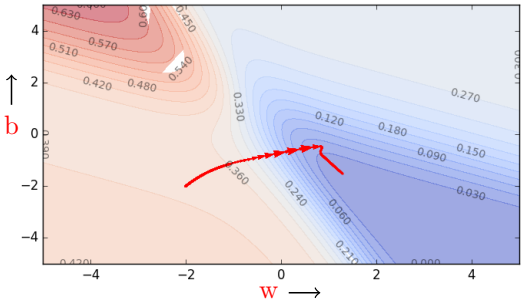
0.5
0.0
−0.5
−1.0
−6
−4
−2
0
2
4
6
0.08 0.16 0.24 0.32 0.40 0.48 0.56 0.64

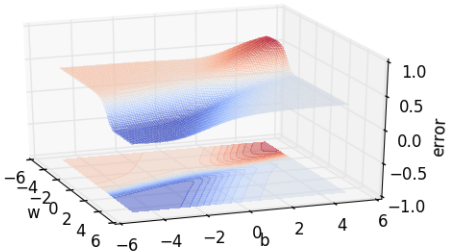


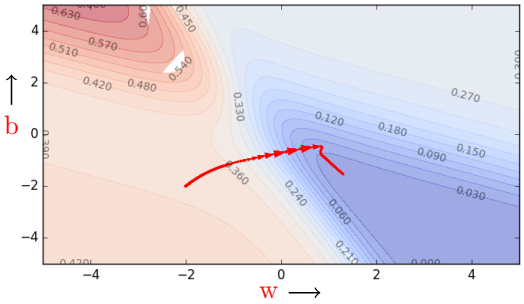
Gradient descent on the error surface



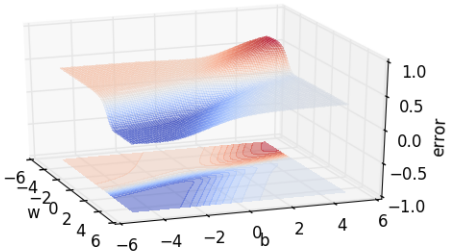


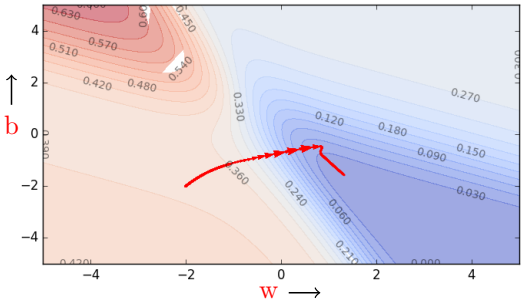
Gradient descent on the error surface



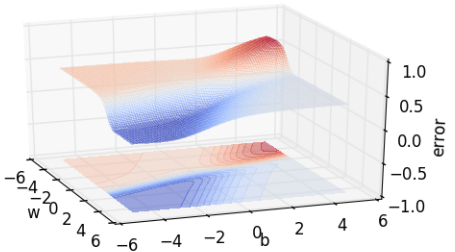


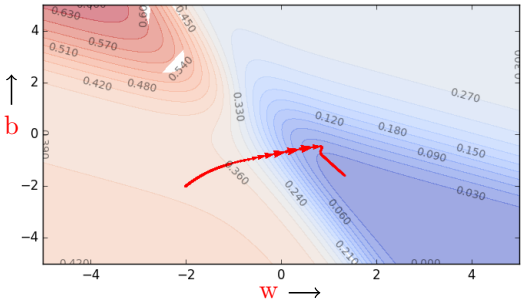
Gradient descent on the error surface



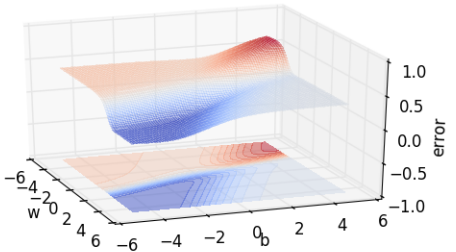


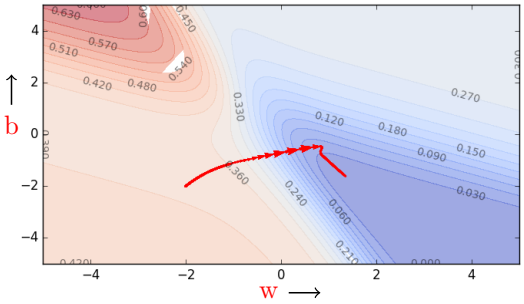
Gradient descent on the error surface





Gradient descent on the error surface




b
w
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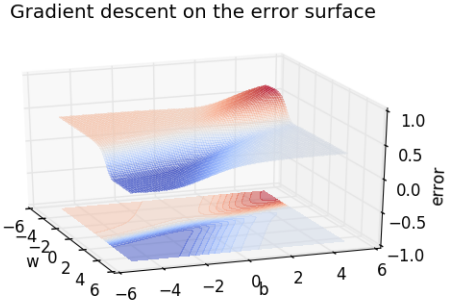
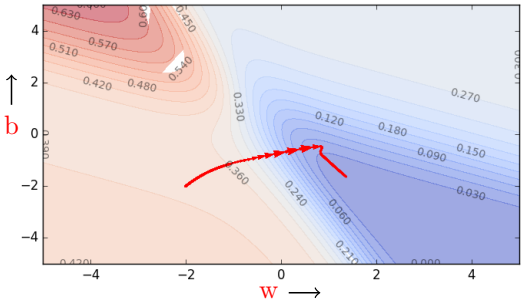
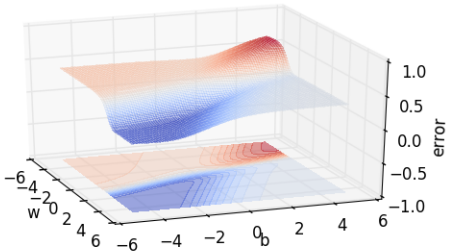
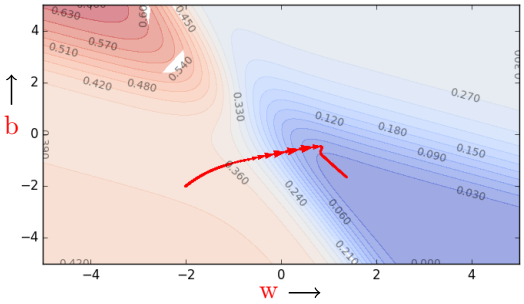
0.570
0.510
0.420
0.480
0.540
0.450
0.330
0.270
0.120
0.180
0.090
0.150
0.360
0.240
0.060
0.030
0.210
0.300
4
2
0
−2
−4
−4
−2
0
2
4
0.00 0.09 0.18 0.27 0.36 0.45 0.54 0.63


Gradient descent on the error surface
error
w
b
1.0
0.5
0.0
−0.5
−1.0
−6
−4
−2
0
2
4
6
0.08 0.16 0.24 0.32 0.40 0.48 0.56 0.64

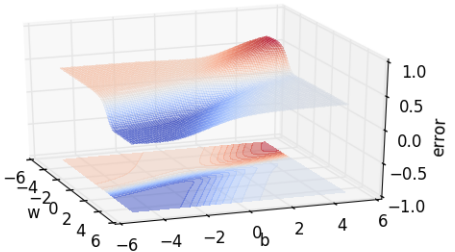


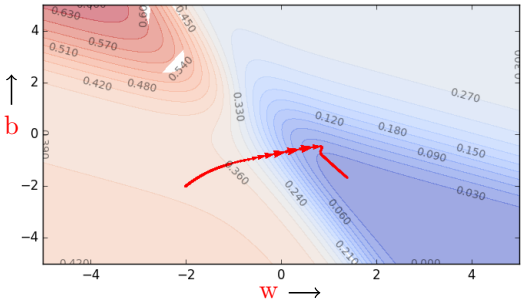
Gradient descent on the error surface



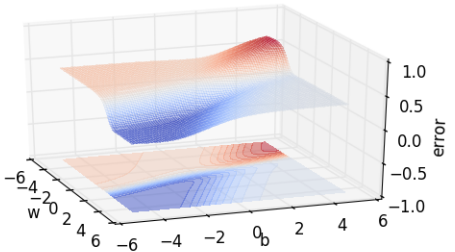


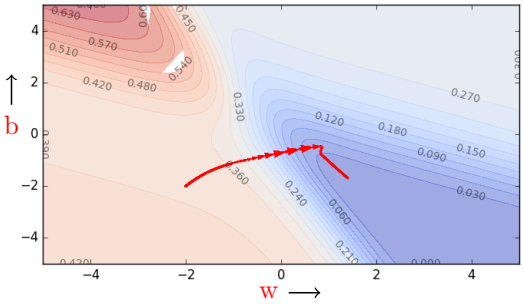
Gradient descent on the error surface



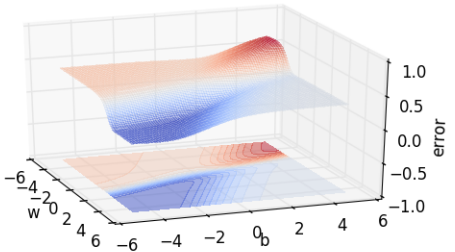


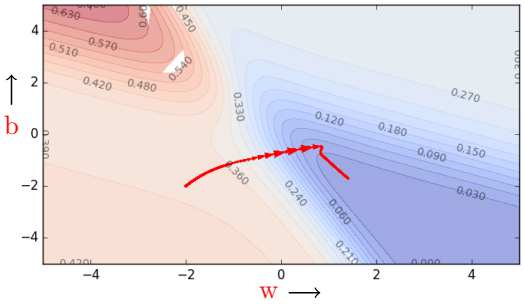
Gradient descent on the error surface



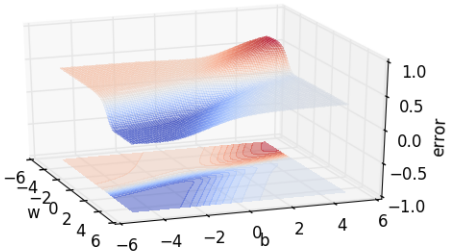


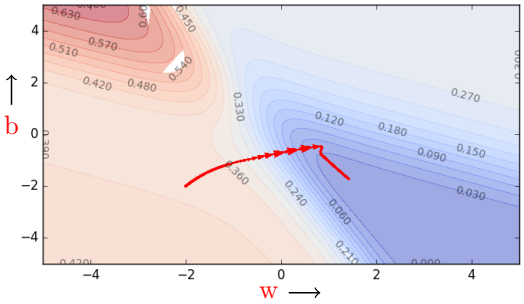
Gradient descent on the error surface



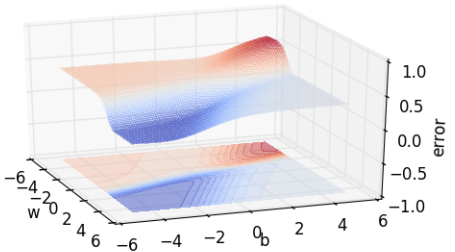


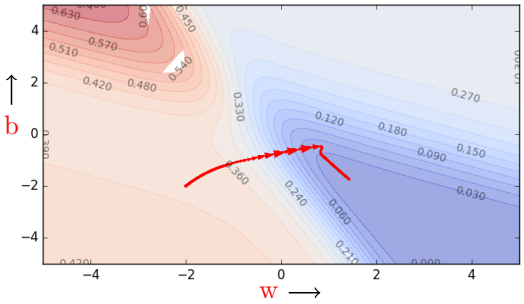
Gradient descent on the error surface



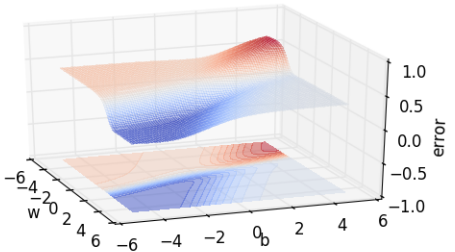


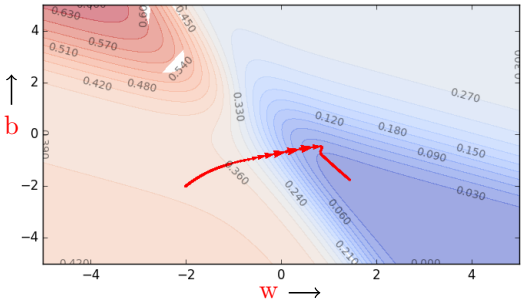
Gradient descent on the error surface



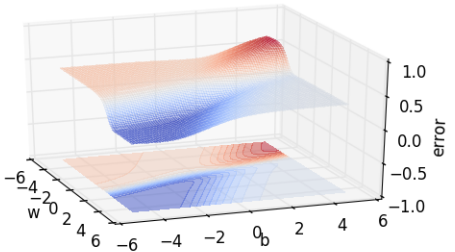


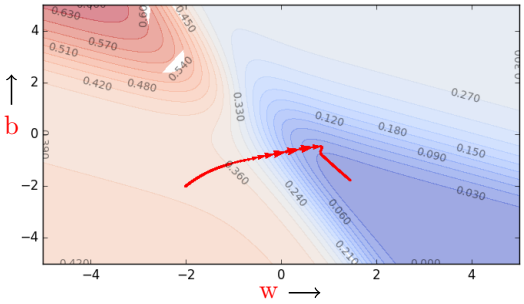
Gradient descent on the error surface



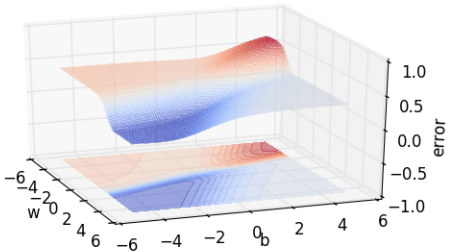


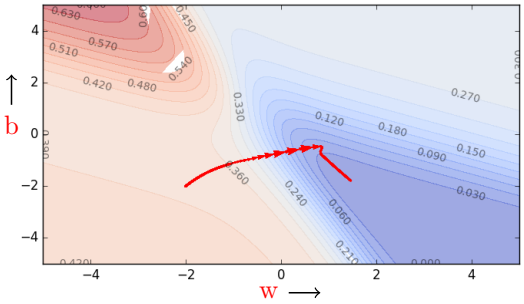
Gradient descent on the error surface





Gradient descent on the error surface





Gradient descent on the error surface