第一种数据布局

高变成[(input\_height-filter\_height)/stride+1]（等于output的高）

宽变成filter\_height\*input\_width

计算卷积的窗口大小filter\_height\*filter\_width

第二种数据布局

高变成[(input\_height-filter\_height)/stride+1]（等于output的高）

宽变成filter\_height\*input\_width\*input\_channel（input\_channel等于filter\_channel）

计算卷积的窗口大小filter\_height\*filter\_width\*fiter\_channel

Input经过数据变换后占用的大小从input\_batch\*input\_channel\*input\_height\* input\_width变成

input\_batch\* input\_channel\*output\_width\*filter\_height\*input\_width\*input\_channel

数据重用率是(output\_width\*filter\_height\*filter\_width-filter\_height\*input\_width)/filter\_height\*input\_width

Conv1-12核的hight和width都是n×n，并且步长小于n

下面的示意图的卷积，步长为1，核为2x2x2(不同颜色是不同channel)

Input

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **00** | **01** | **02** |  | **00** | **01** | **02** |
| **10** | **11** | **12** |  | **10** | **11** | **12** |
| **20** | **21** | **22** |  | **20** | **21** | **22** |

Im2win张量

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **00** | **10** | **01** | **11** | **02** | **12** |  | **00** | **10** | **01** | **11** | **02** | **12** |
| **10** | **20** | **11** | **21** | **12** | **22** |  | **10** | **20** | **11** | **21** | **12** | **22** |

卷积核

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **00** | **10** | **01** | **11** |  | **00** | **10** | **01** | **11** |

第二种数据布局（把所有channel也放到窗口）

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **00** | **00** | **10** | **10** | **01** | **01** | **11** | **11** | **02** | **02** | **12** | **12** |
| **10** | **10** | **20** | **20** | **11** | **11** | **21** | **21** | **12** | **12** | **22** | **22** |

卷积核

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **00** | **00** | **10** | **10** | **01** | **01** | **11** | **11** |

Output（和input的布局一样）

|  |  |
| --- | --- |
| **00** | **01** |
| **10** | **11** |

步长为2，核为2x2

|  |  |  |  |
| --- | --- | --- | --- |
| **00** | **01** | **02** | **03** |
| **10** | **11** | **12** | **13** |
| **20** | **21** | **22** | **23** |
| **30** | **31** | **32** | **33** |

Im2win矩阵

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **00** | **10** | **01** | **11** | **02** | **12** | **03** | **13** |
| **20** | **30** | **21** | **31** | **22** | **32** | **23** | **33** |

步长为2，核为1x1

|  |  |  |
| --- | --- | --- |
| **00** | **01** | **02** |
| **10** | **11** | **12** |
| **20** | **21** | **22** |

Im2win矩阵

|  |  |  |
| --- | --- | --- |
| **00** | **01** | **02** |
| **20** | **21** | **22** |

步长为2，核为3x3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **00** | **01** | **02** | **03** | **04** |
| **10** | **11** | **12** | **13** | **14** |
| **20** | **21** | **22** | **23** | **24** |
| **30** | **31** | **32** | **33** | **34** |
| **40** | **41** | **42** | **43** | **44** |

Im2win矩阵

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **00** | **10** | **20** | **01** | **11** | **21** | **02** | **12** | **22** | **03** | **13** | **23** | **04** | **14** | **24** |
| **20** | **30** | **40** | **21** | **31** | **41** | **22** | **32** | **42** | **23** | **33** | **43** | **24** | **34** | **44** |

步长为1，核为3x2（宽3高2）

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **00** | **01** | **02** | **03** | **04** |
| **10** | **11** | **12** | **13** | **14** |
| **20** | **21** | **22** | **23** | **24** |
| **30** | **31** | **32** | **33** | **34** |

Im2win矩阵

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **00** | **10** | **01** | **11** | **02** | **12** | **03** | **13** | **04** | **14** |
| **10** | **20** | **11** | **21** | **12** | **22** | **13** | **23** | **14** | **24** |
| **20** | **30** | **21** | **31** | **22** | **32** | **23** | **33** | **24** | **34** |

步长为1，核为2x3（宽2高3）

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **00** | **01** | **02** | **03** | **04** |
| **10** | **11** | **12** | **13** | **14** |
| **20** | **21** | **22** | **23** | **24** |
| **30** | **31** | **32** | **33** | **34** |

Im2win矩阵

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **00** | **10** | **20** | **01** | **11** | **21** | **02** | **12** | **22** | **03** | **13** | **23** | **04** | **14** | **24** |
| **10** | **20** | **30** | **11** | **21** | **31** | **12** | **22** | **32** | **13** | **23** | **33** | **14** | **24** | **34** |

**卷积运算**

**卷积核**

|  |  |  |  |
| --- | --- | --- | --- |
| **f00** | **f10** | **f01** | **f11** |

**Im2win矩阵**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **00** | **10** | **01** | **11** | **02** | **12** |
| **10** | **20** | **11** | **21** | **12** | **22** |

**结果**

|  |  |
| --- | --- |
| **00** | **01** |
| **10** | **11** |