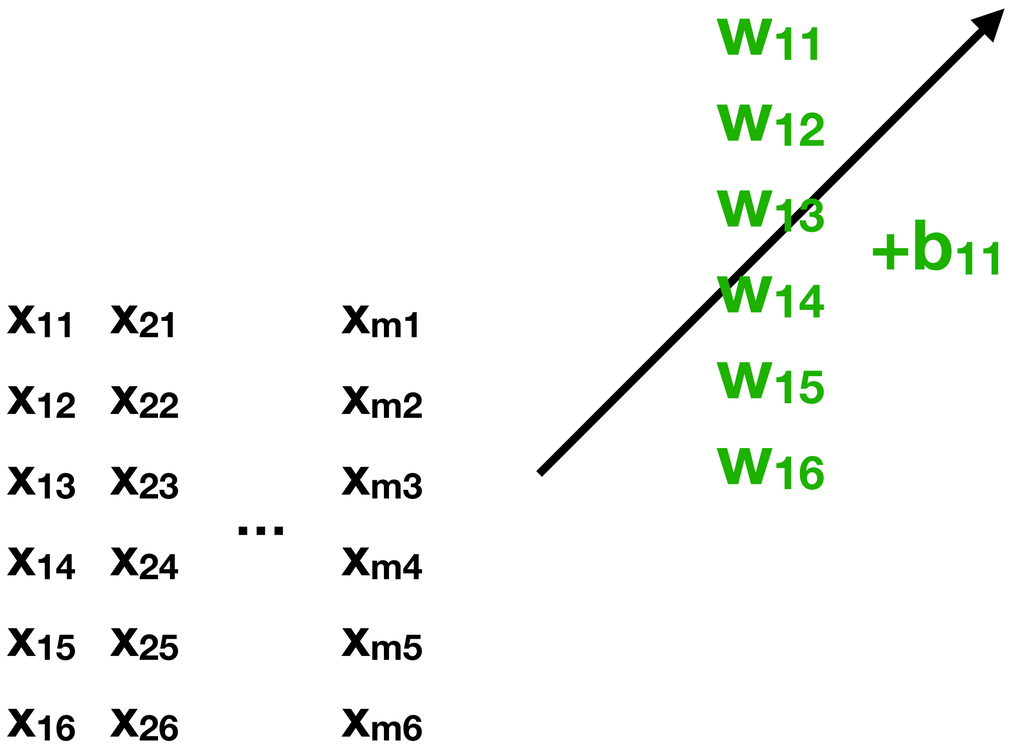
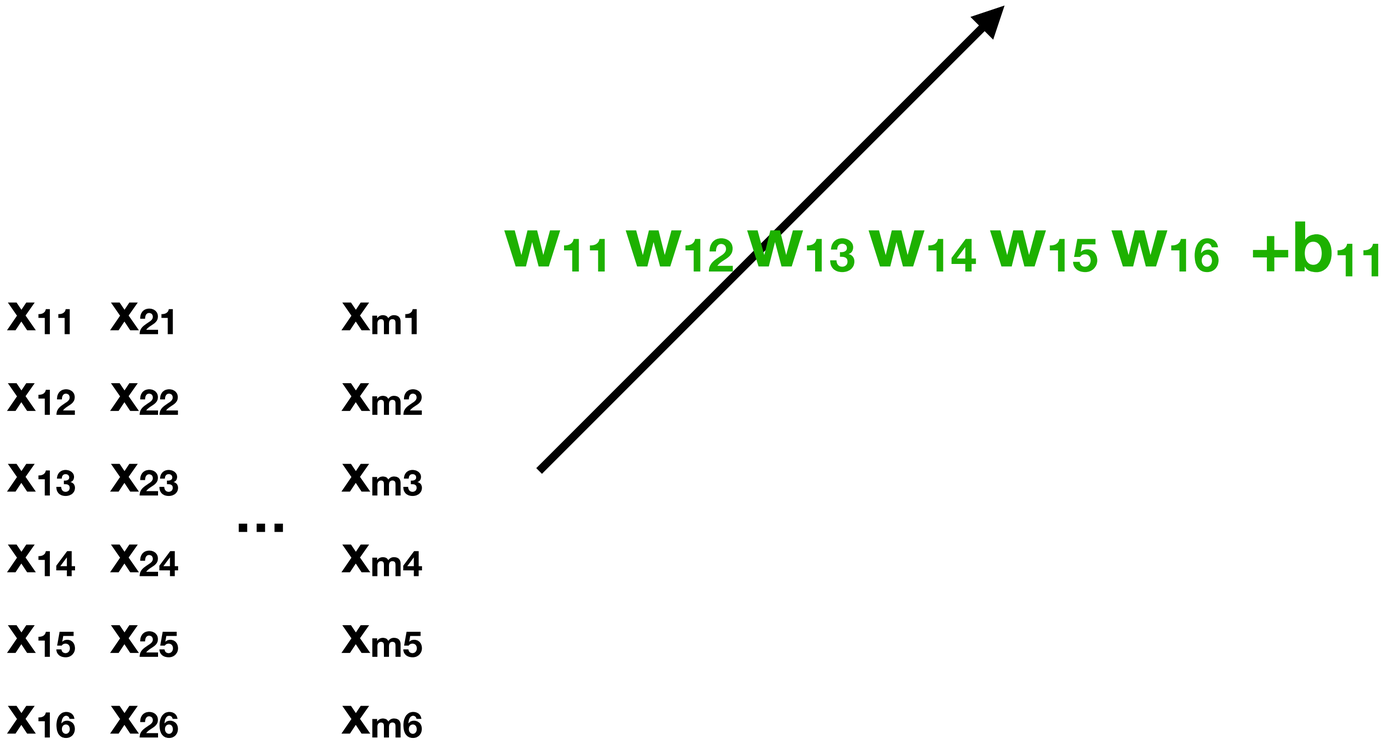
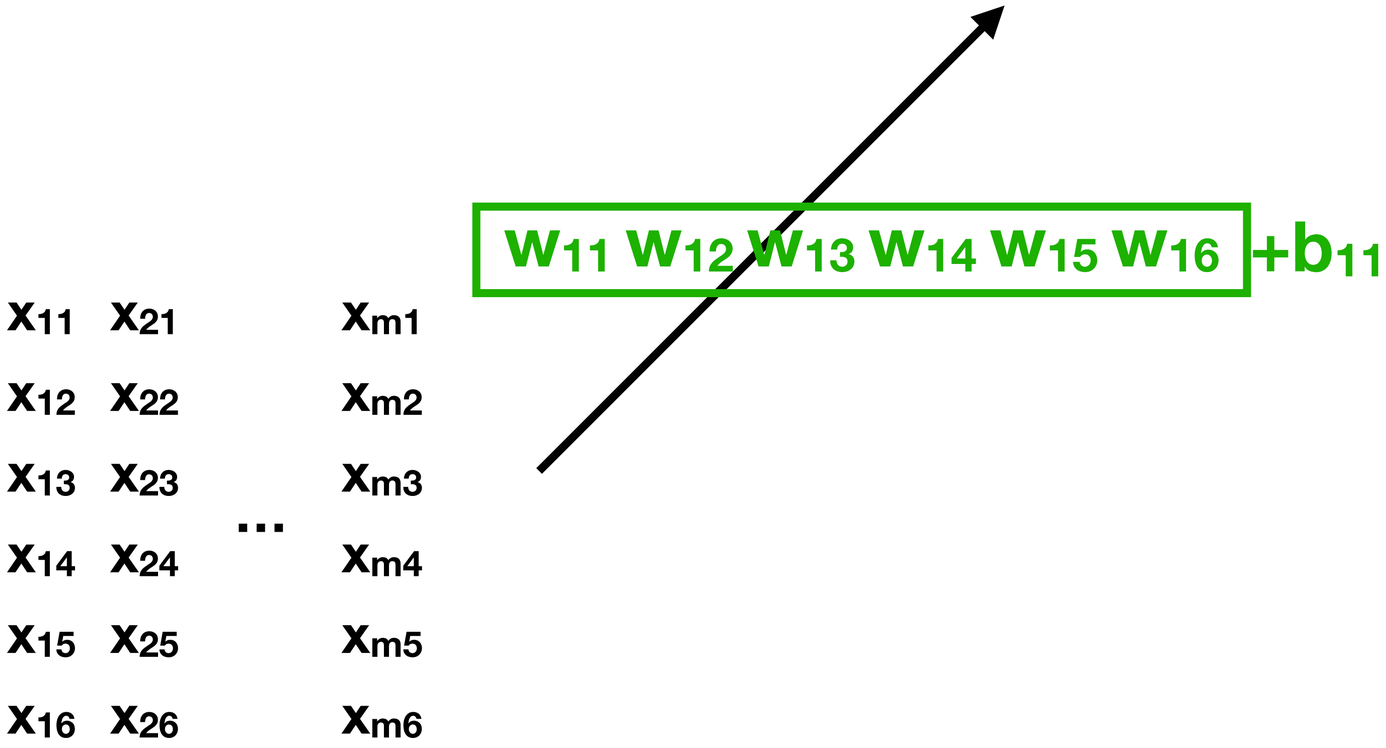
SC201

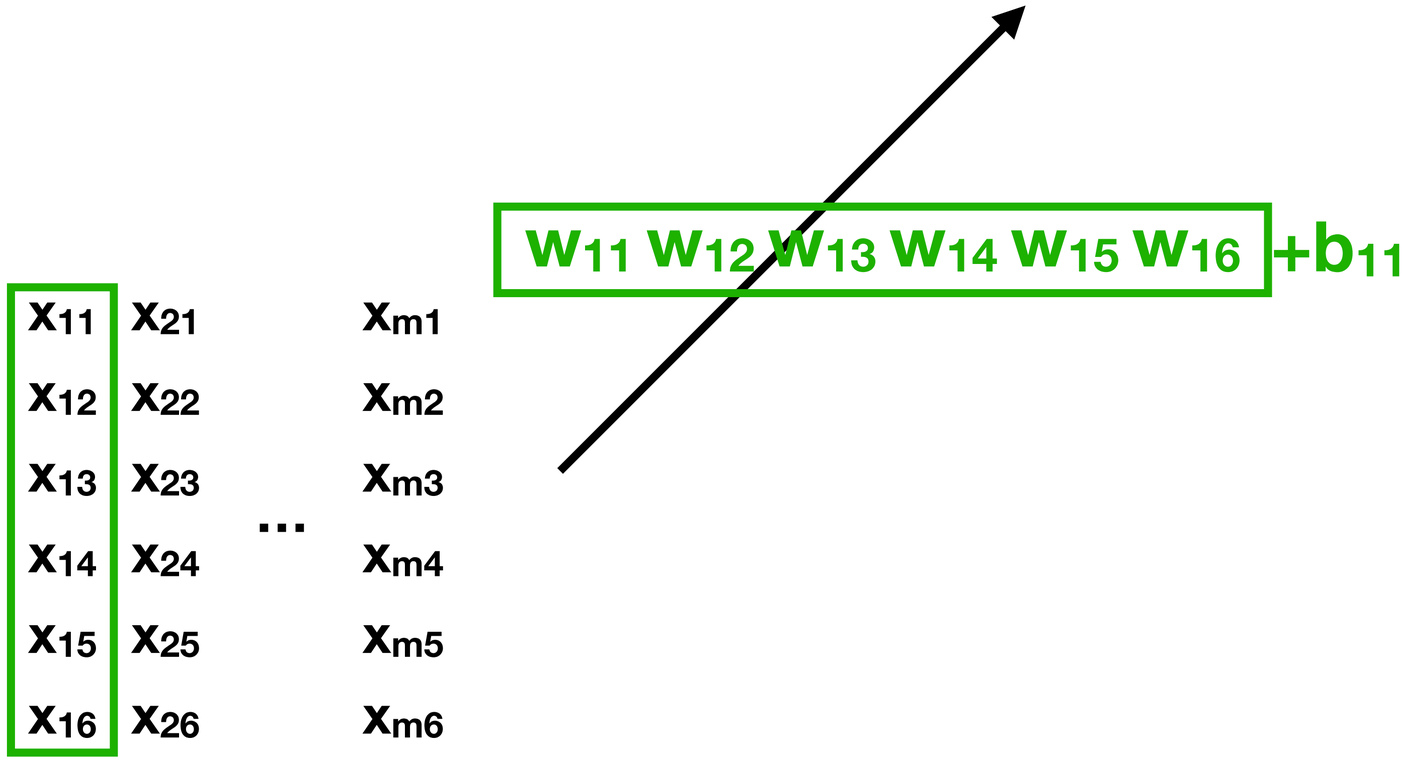
Lecture 10

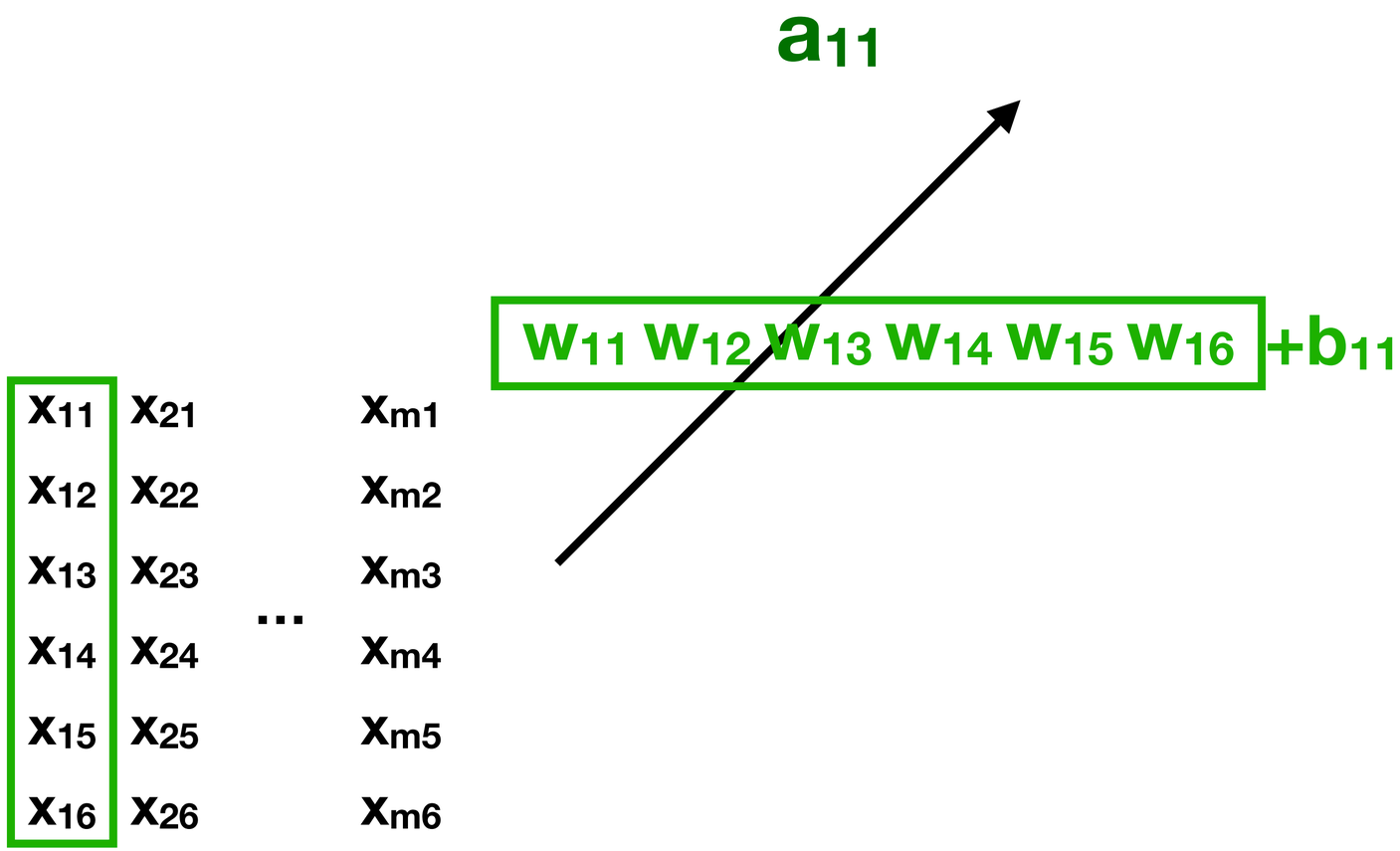
$$
\begin{matrix}
x_{11} & x_{21} & & x_{m1} \\
x_{12} & x_{22} & & x_{m2} \\
x_{13} & x_{23} & & x_{m3} \\
 & & \cdots & \\
x_{14} & x_{24} & & x_{m4} \\
x_{15} & x_{25} & & x_{m5} \\
x_{16} & x_{26} & & x_{m6}
\end{matrix}
$$

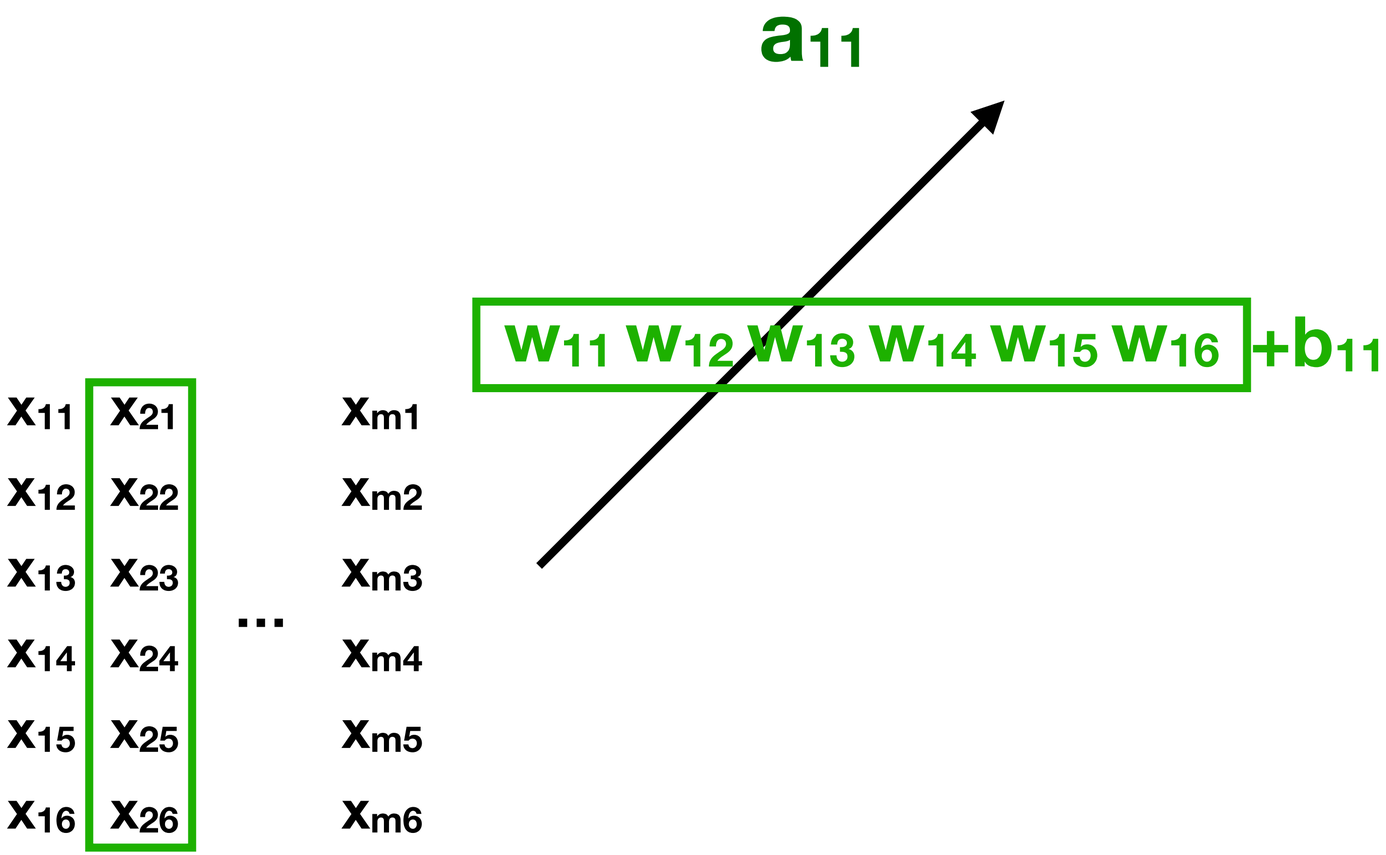

x_{11} x_{21} x_{m1}
x_{12} x_{22} x_{m2}
x_{13} x_{23} x_{m3}
...
x_{14} x_{24} x_{m4}
x_{15} x_{25} x_{m5}
x_{16} x_{26} x_{m6}
w_{11}
w_{12}
w_{13}
w_{14}
w_{15}
w_{16}
$+b_{11}$

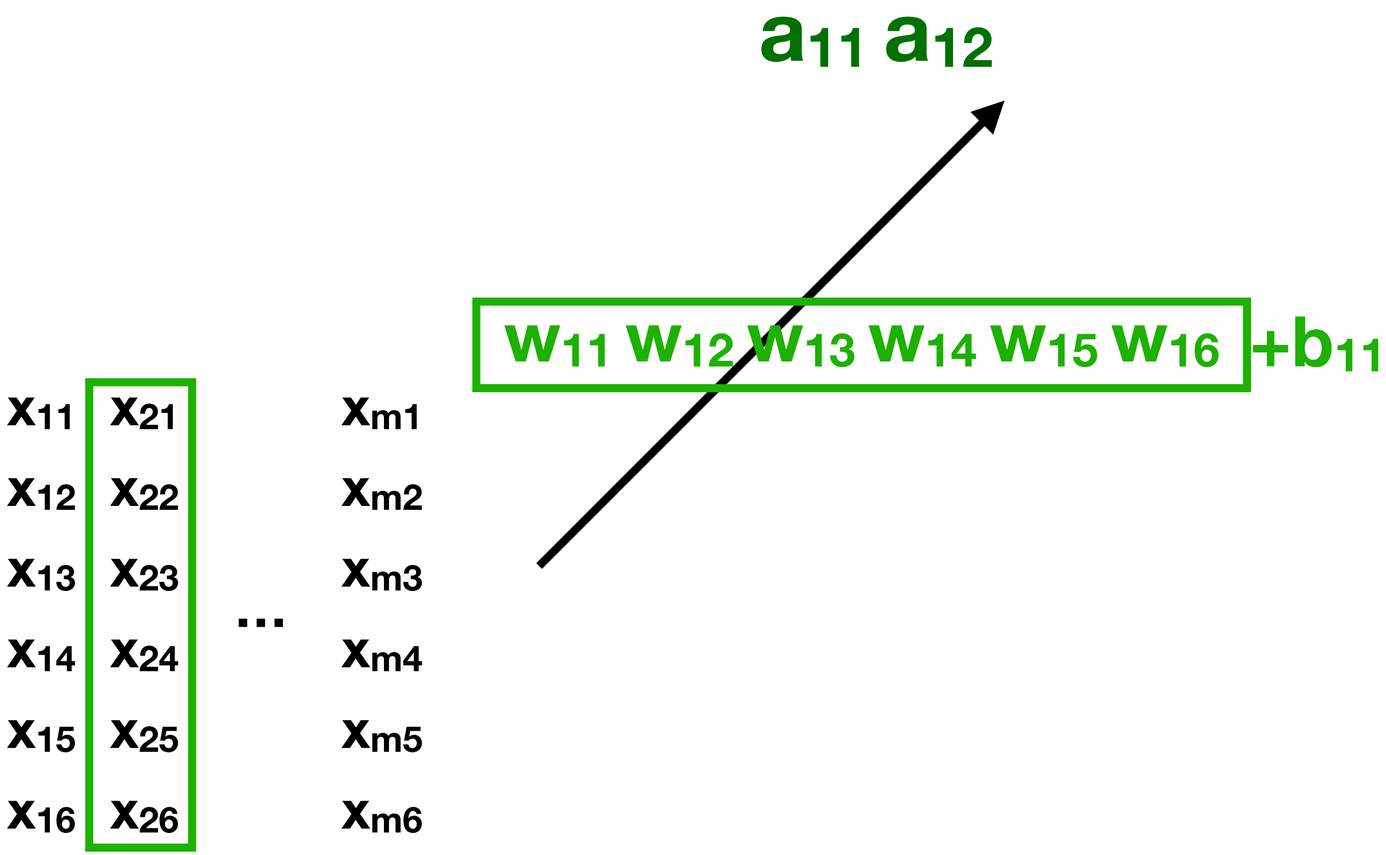

w11 w12 w13 w14 w15 w16 +b11
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6

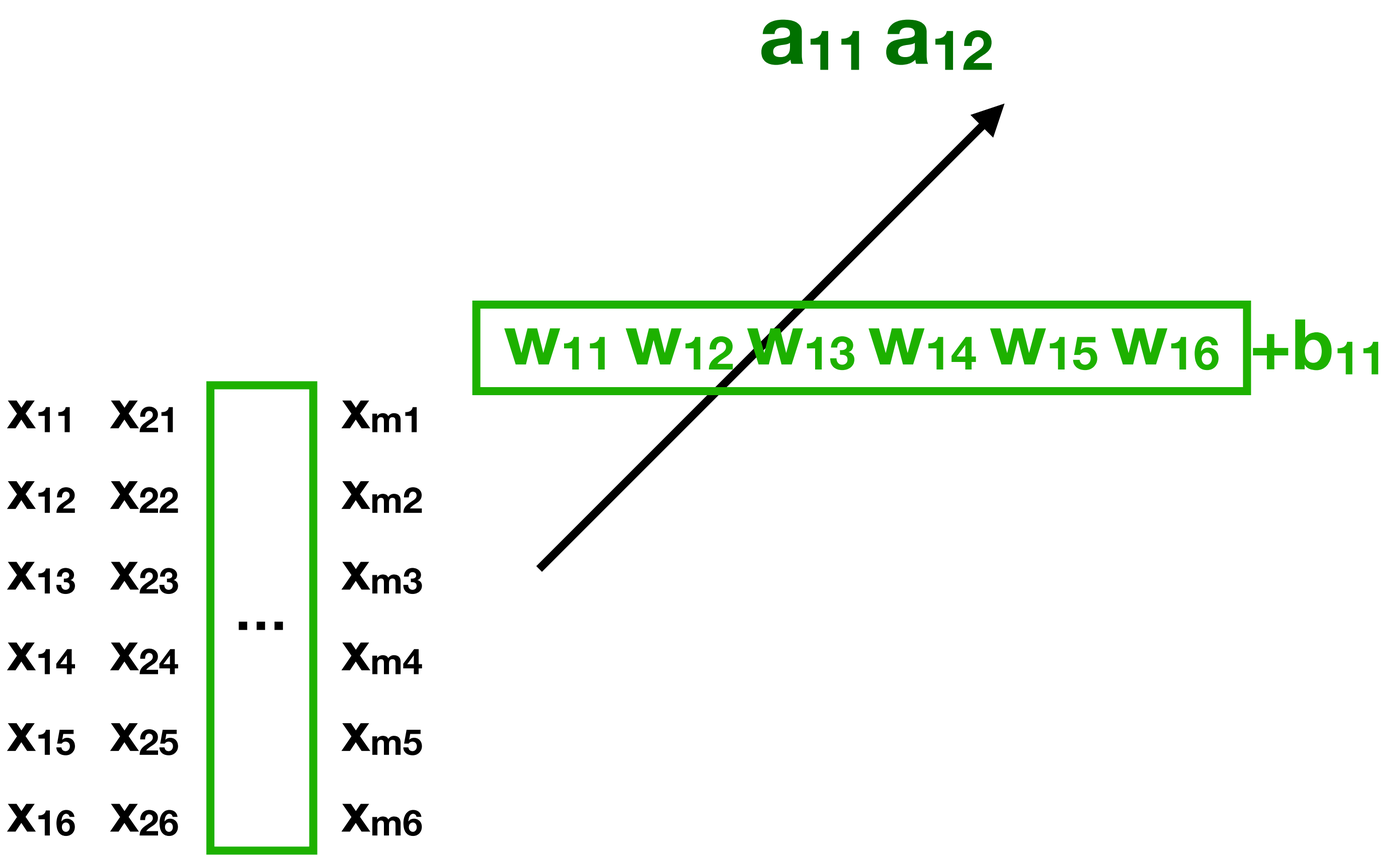

w_{11} w_{12} w_{13} w_{14} w_{15} w_{16} $+b_{11}$
x_{11} x_{21} x_{m1}
x_{12} x_{22} x_{m2}
x_{13} x_{23} x_{m3}
...
x_{14} x_{24} x_{m4}
x_{15} x_{25} x_{m5}
x_{16} x_{26} x_{m6}

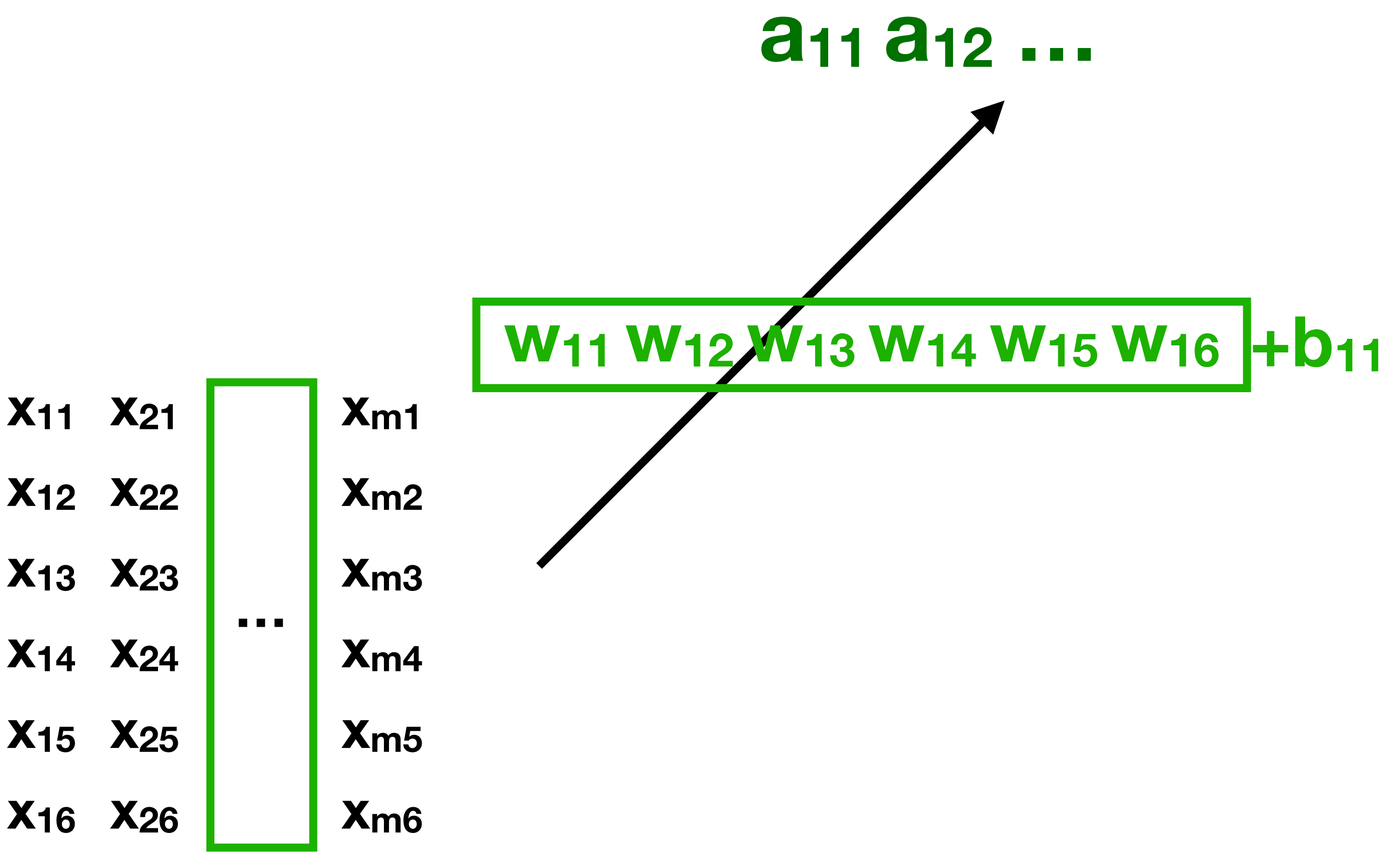

$w_{11}\ w_{12}\ w_{13}\ w_{14}\ w_{15}\ w_{16}$
$+b_{11}$
x_{11} x_{21} x_{m1}
x_{12} x_{22} x_{m2}
x_{13} x_{23} x_{m3}
...
x_{14} x_{24} x_{m4}
x_{15} x_{25} x_{m5}
x_{16} x_{26} x_{m6}

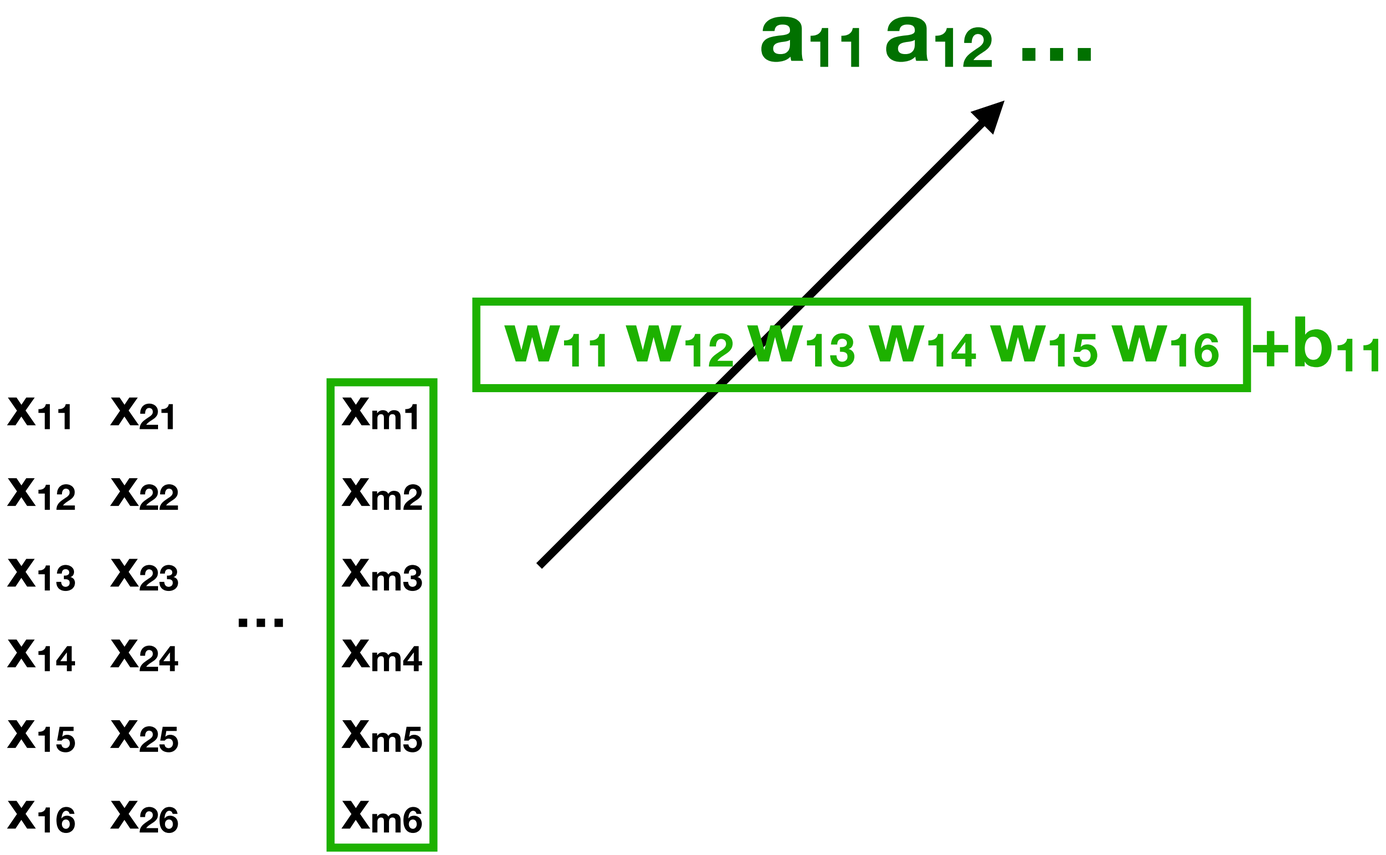

a11
w11 w12 w13 w14 w15 w16
+b11
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
...

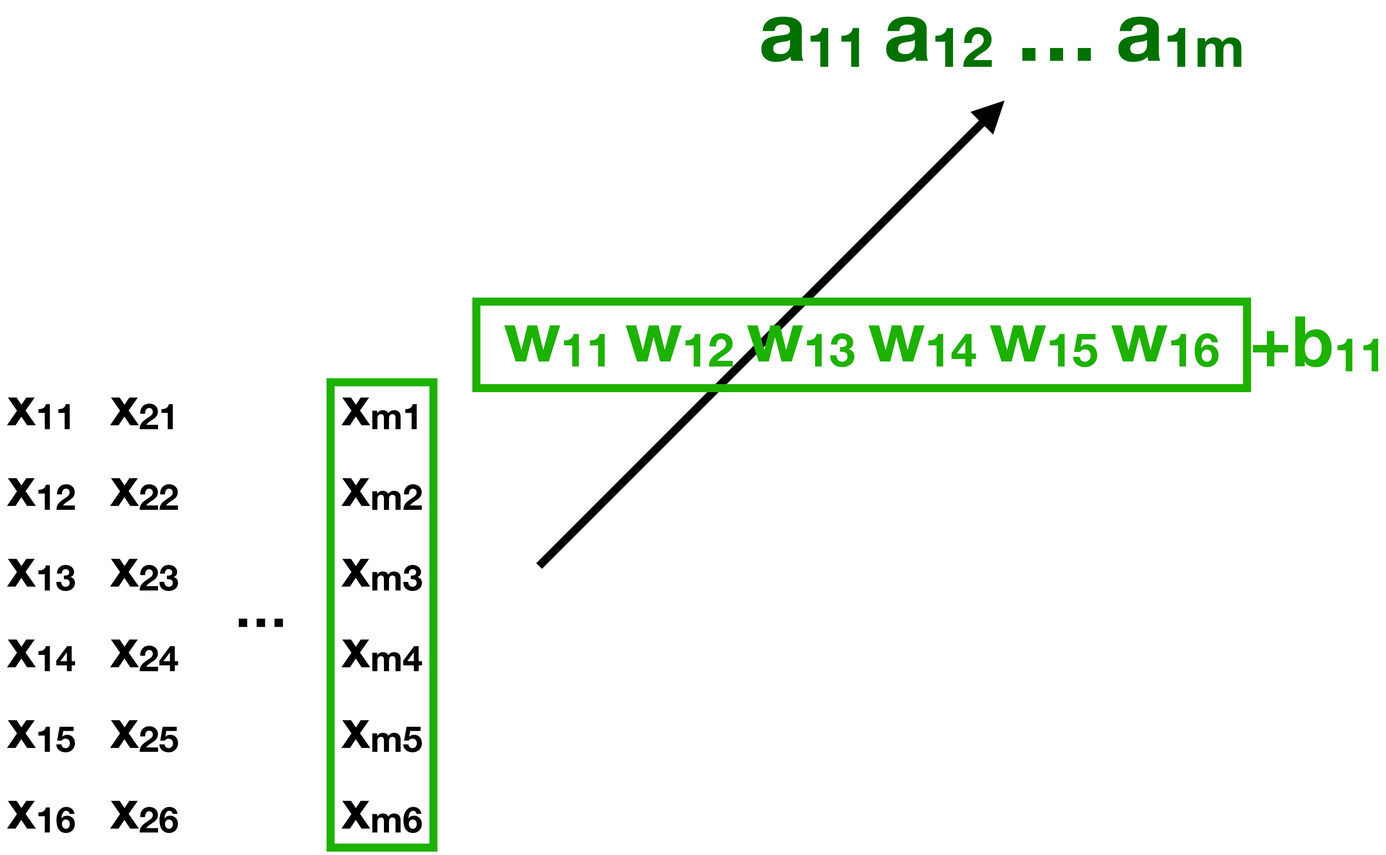

a_{11}
w_{11} w_{12} w_{13} w_{14} w_{15} w_{16} $+b_{11}$
x_{11} x_{21} x_{m1}
x_{12} x_{22} x_{m2}
x_{13} x_{23} x_{m3}
...
x_{14} x_{24} x_{m4}
x_{15} x_{25} x_{m5}
x_{16} x_{26} x_{m6}


a11 a12
w11 w12 w13 w14 w15 w16
+b11
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
...

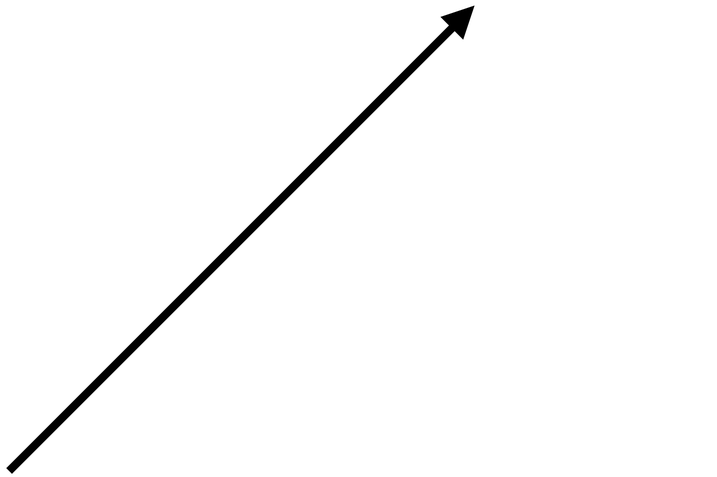

a11 a12
w11 w12 w13 w14 w15 w16
+b11
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
...
xm1
xm2
xm3
xm4
xm5
xm6


a11 a12 ...
w11 w12 w13 w14 w15 w16
+b11
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
...
xm1
xm2
xm3
xm4
xm5
xm6


a11 a12 ...
w11 w12 w13 w14 w15 w16
+b11
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
...
xm1
xm2
xm3
xm4
xm5
xm6


a11 a12 ... a1m
w11 w12 w13 w14 w15 w16
+b11
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
...
xm1
xm2
xm3
xm4
xm5
xm6

$a_{11}\ a_{12}\ \ldots\ a_{1m}$



$x_{11}\ x_{21}\ \ldots\ x_{m1}$

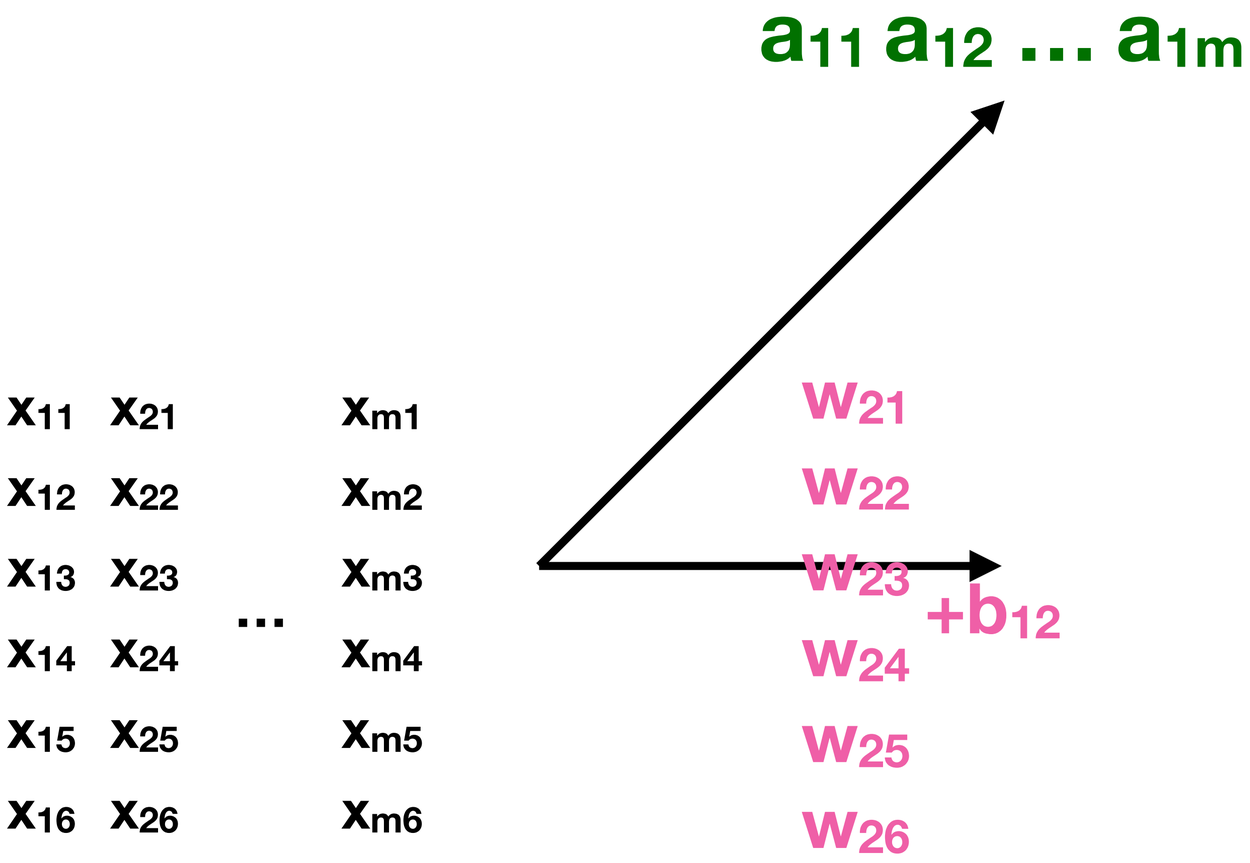
$x_{12}\ x_{22}\ \ldots\ x_{m2}$

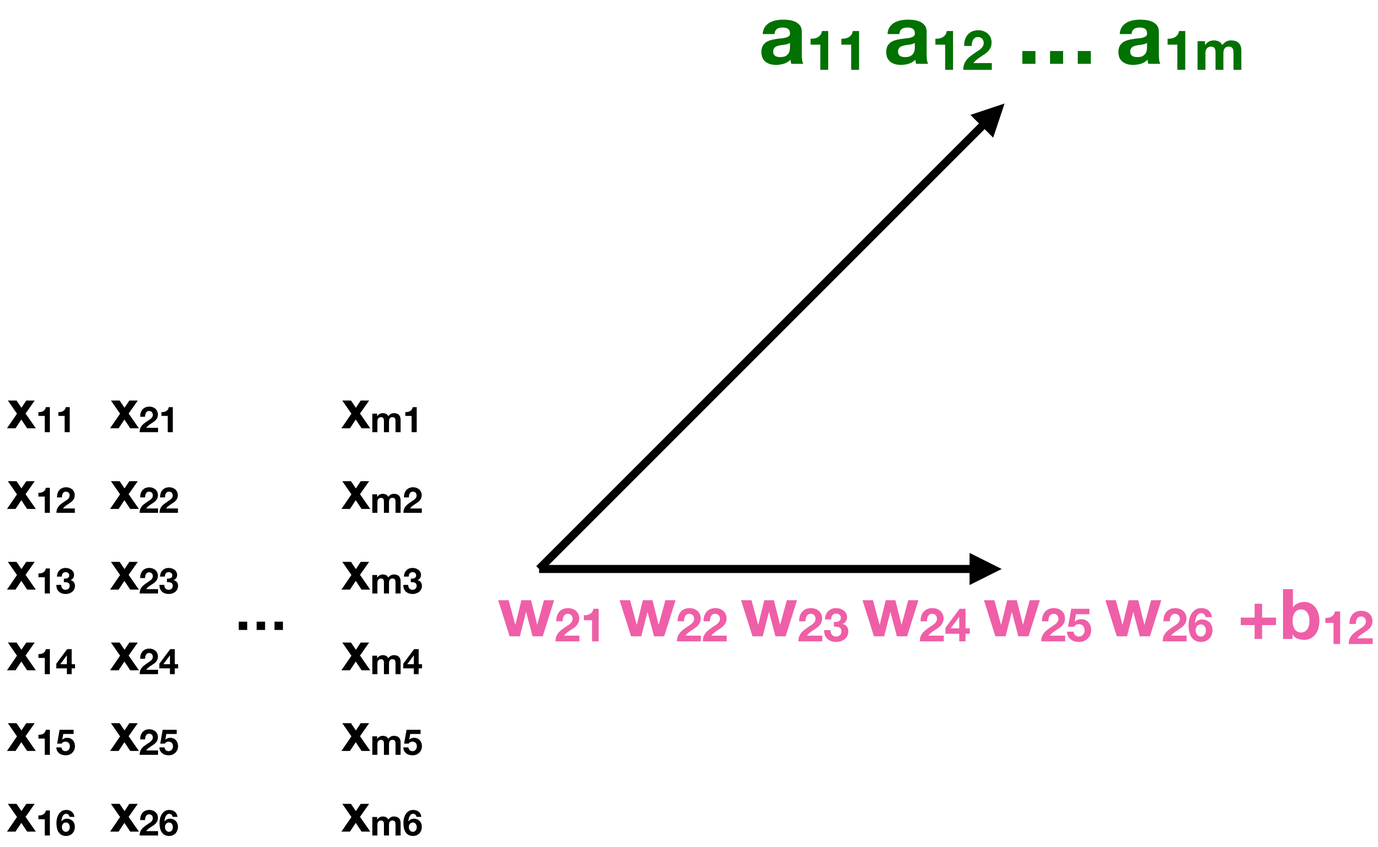
$x_{13}\ x_{23}\ \ldots\ x_{m3}$

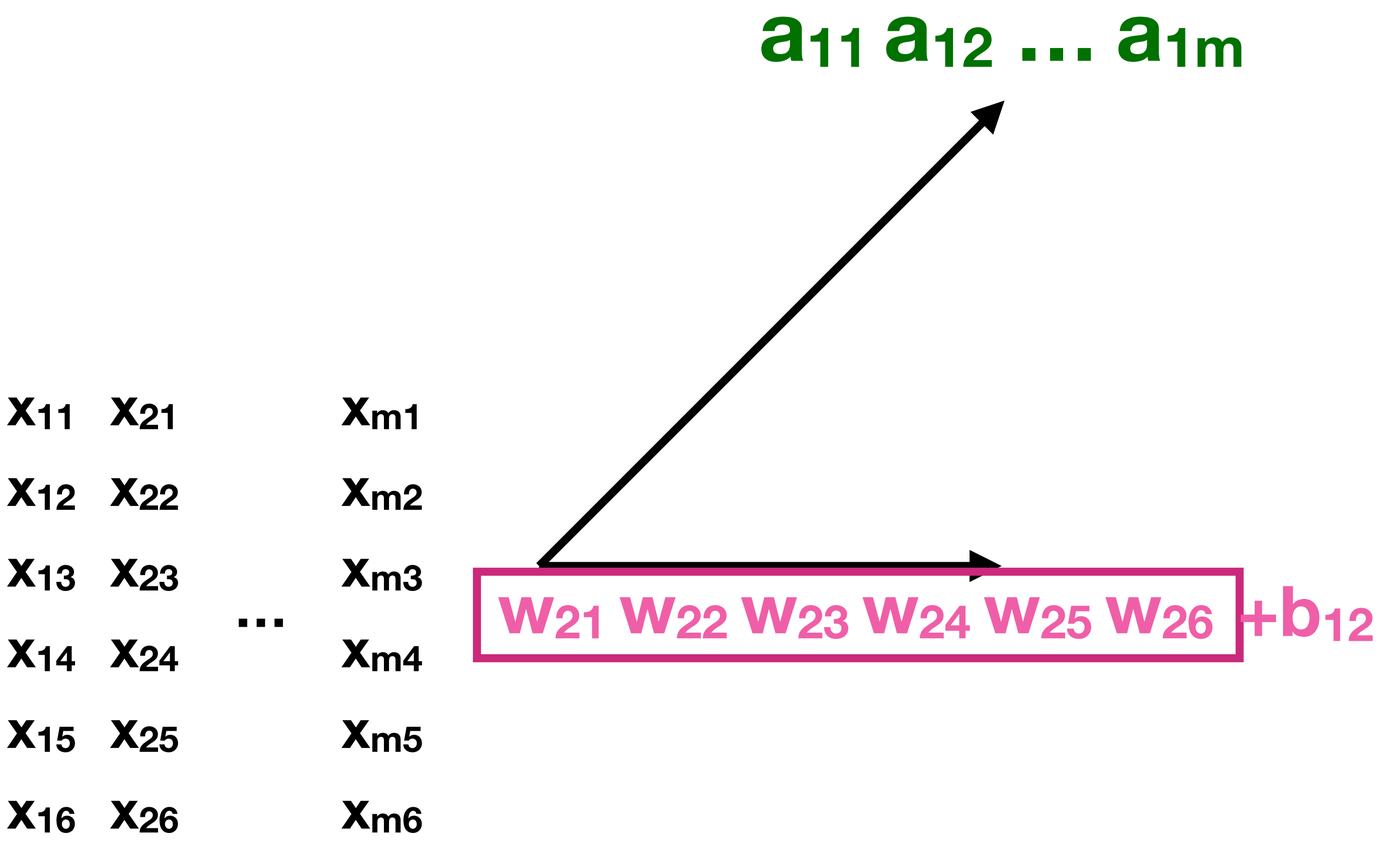
$x_{14}\ x_{24}\ \ldots\ x_{m4}$

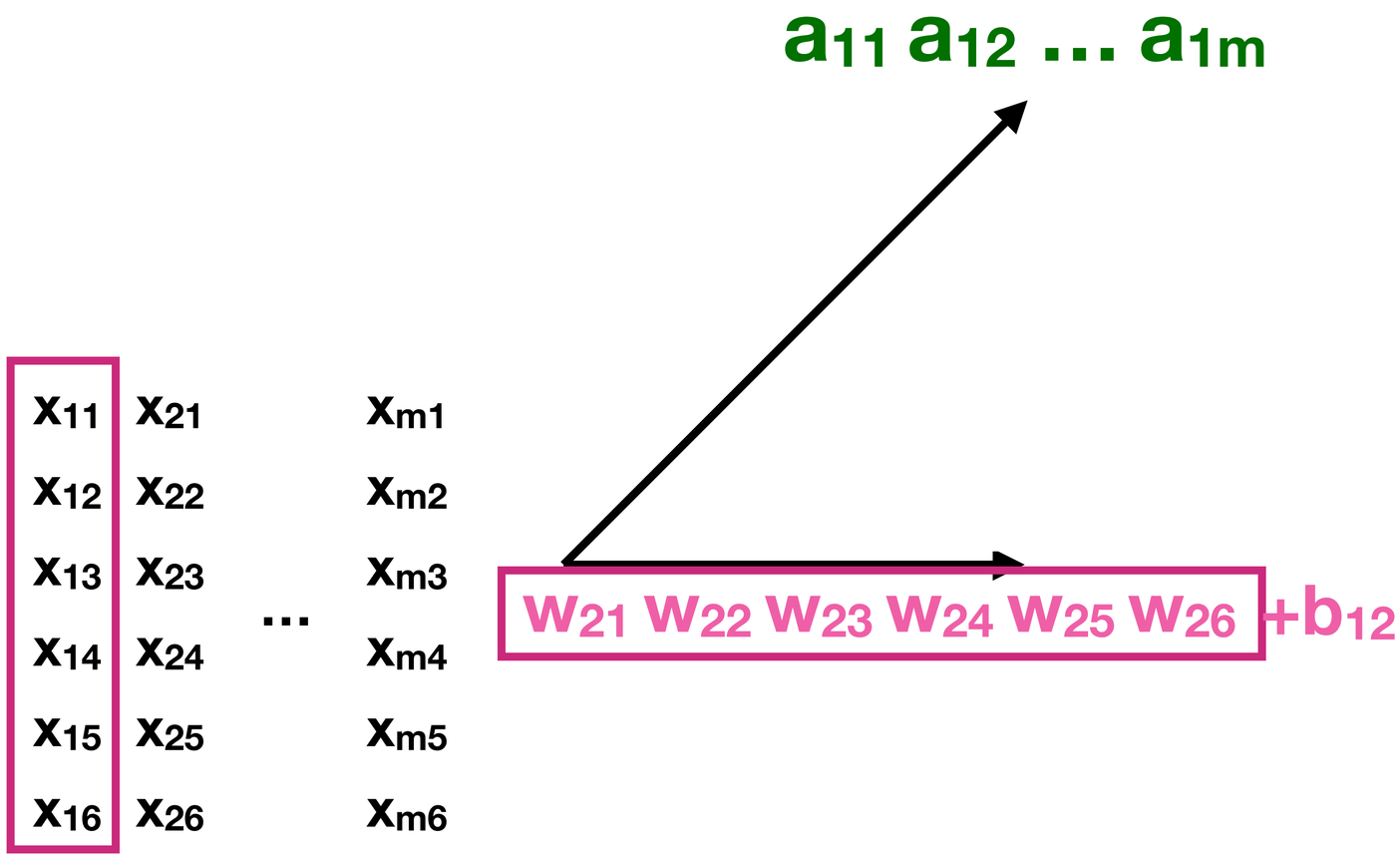
$x_{15}\ x_{25}\ \ldots\ x_{m5}$

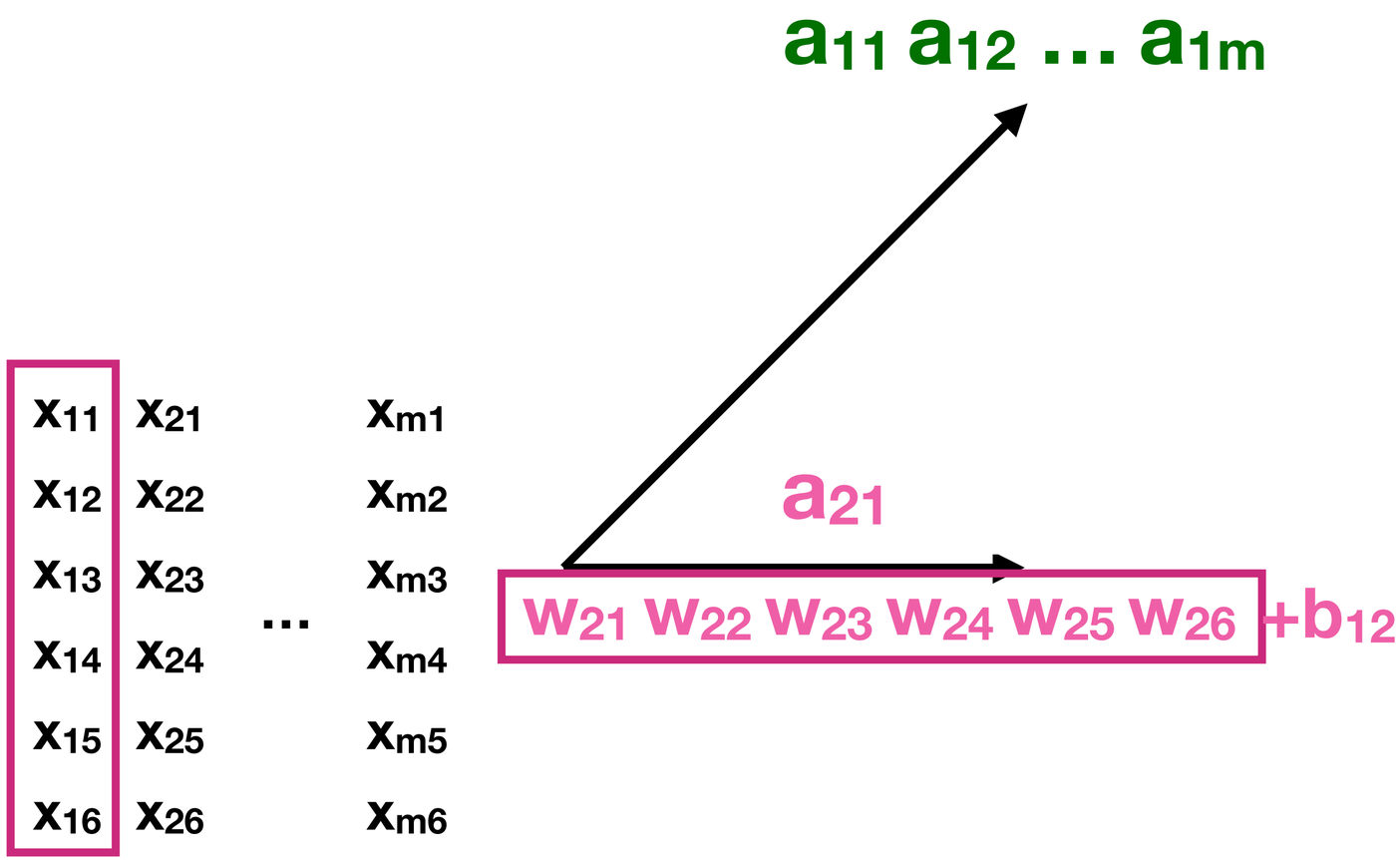
$x_{16}\ x_{26}\ \ldots\ x_{m6}$

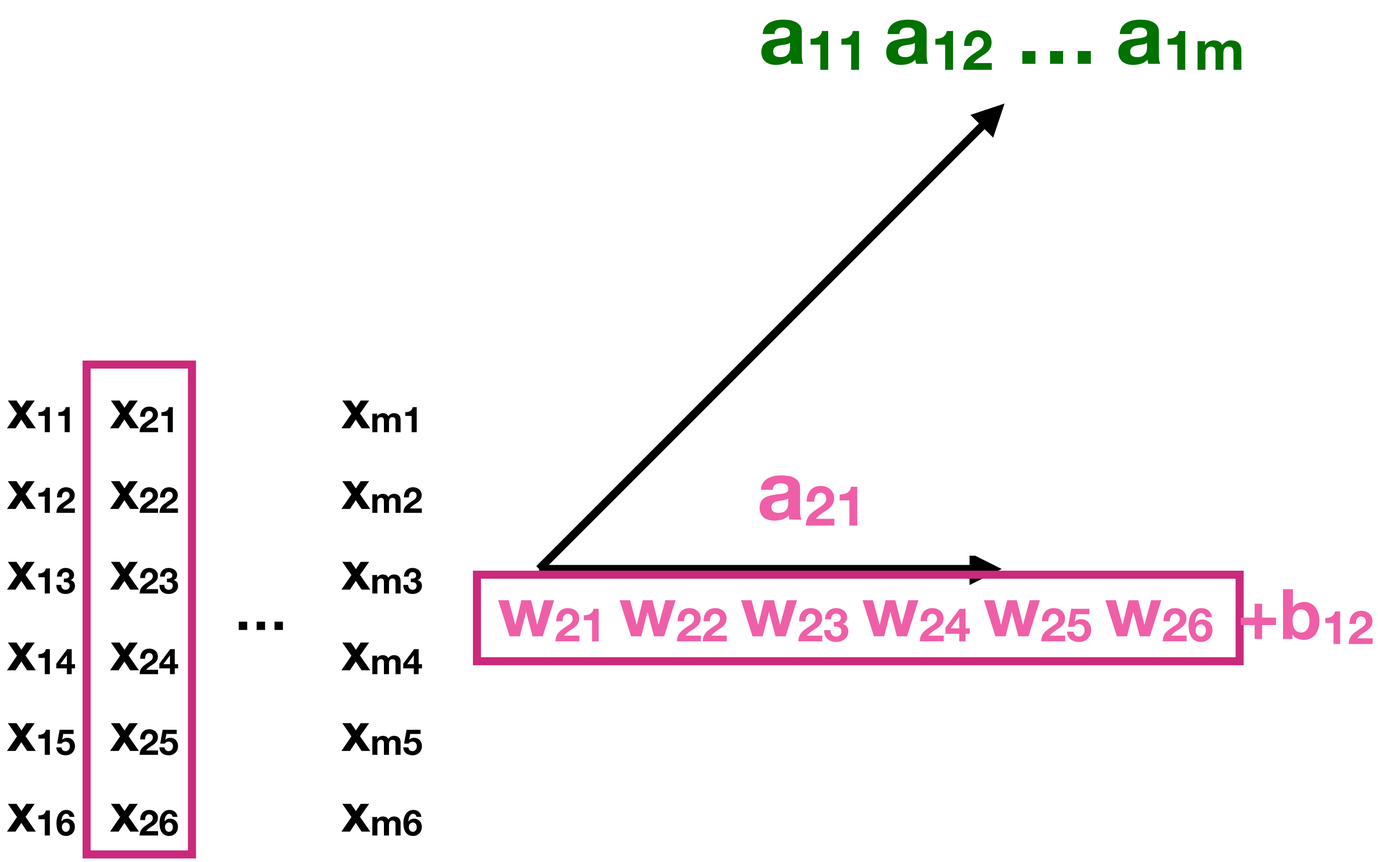

a11 a12 ... a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w21
w22
w23
+b12
w24
w25
w26

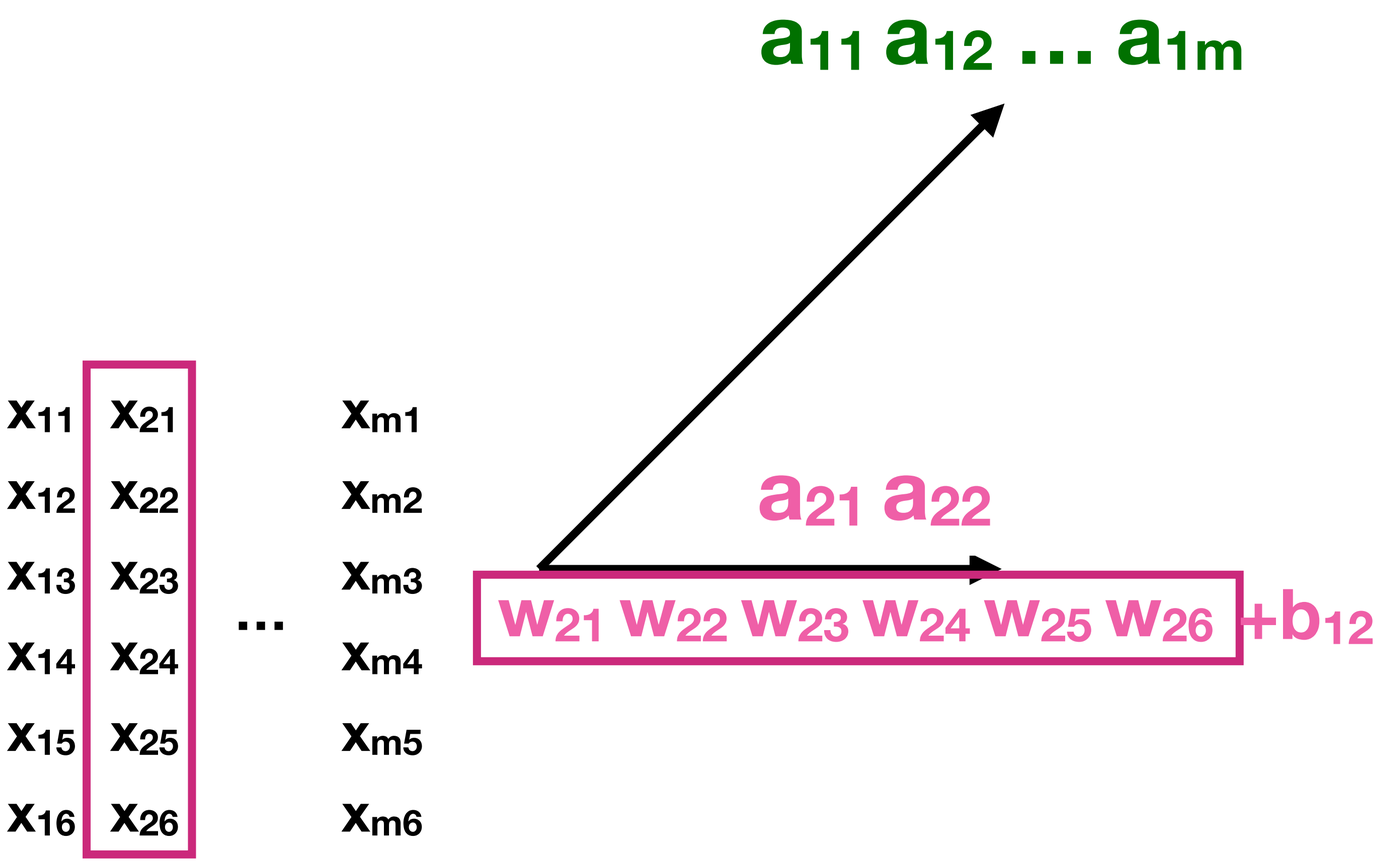

a11 a12 ... a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w21 w22 w23 w24 w25 w26 +b12

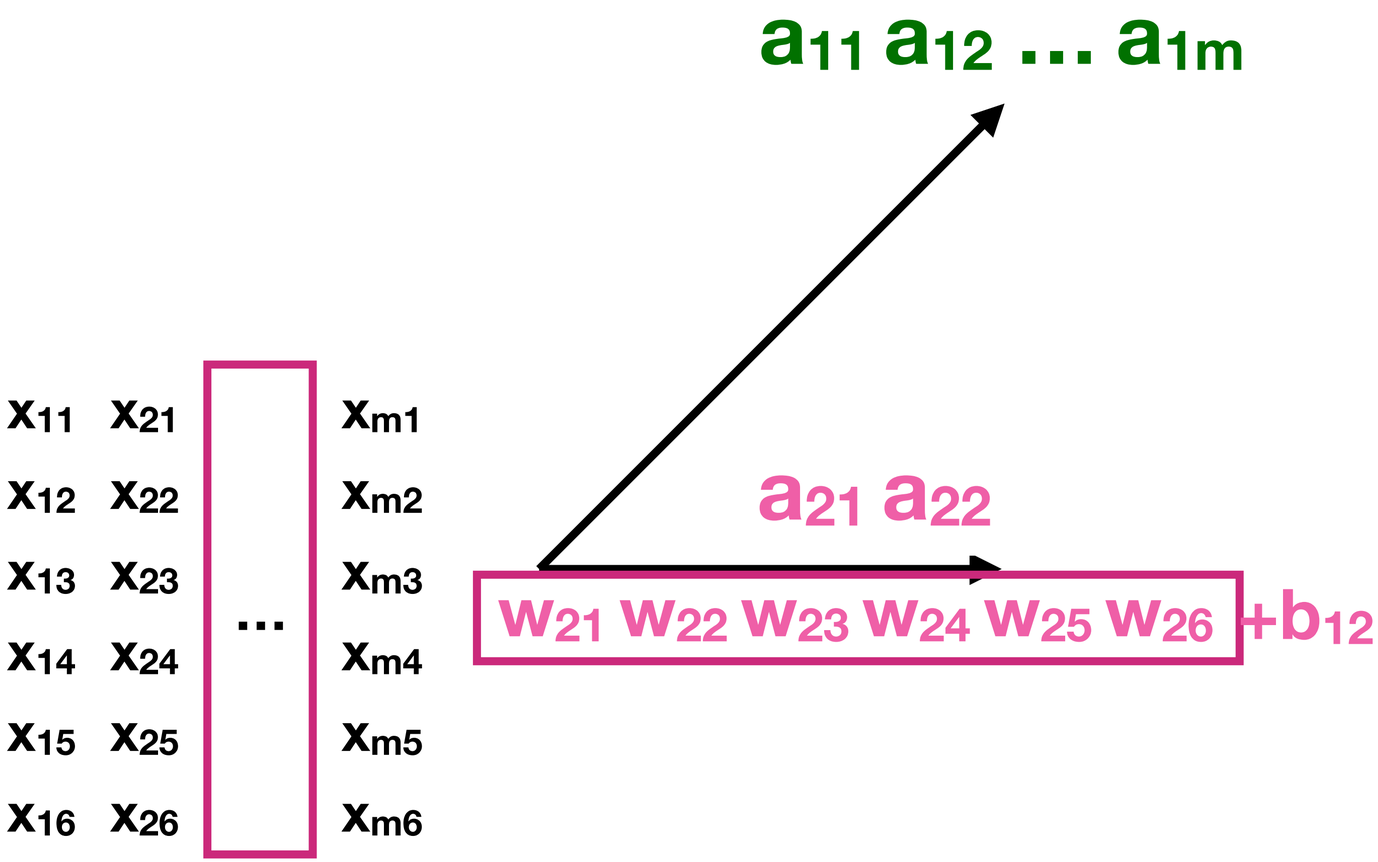

a11 a12 ... a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w21 w22 w23 w24 w25 w26 +b12

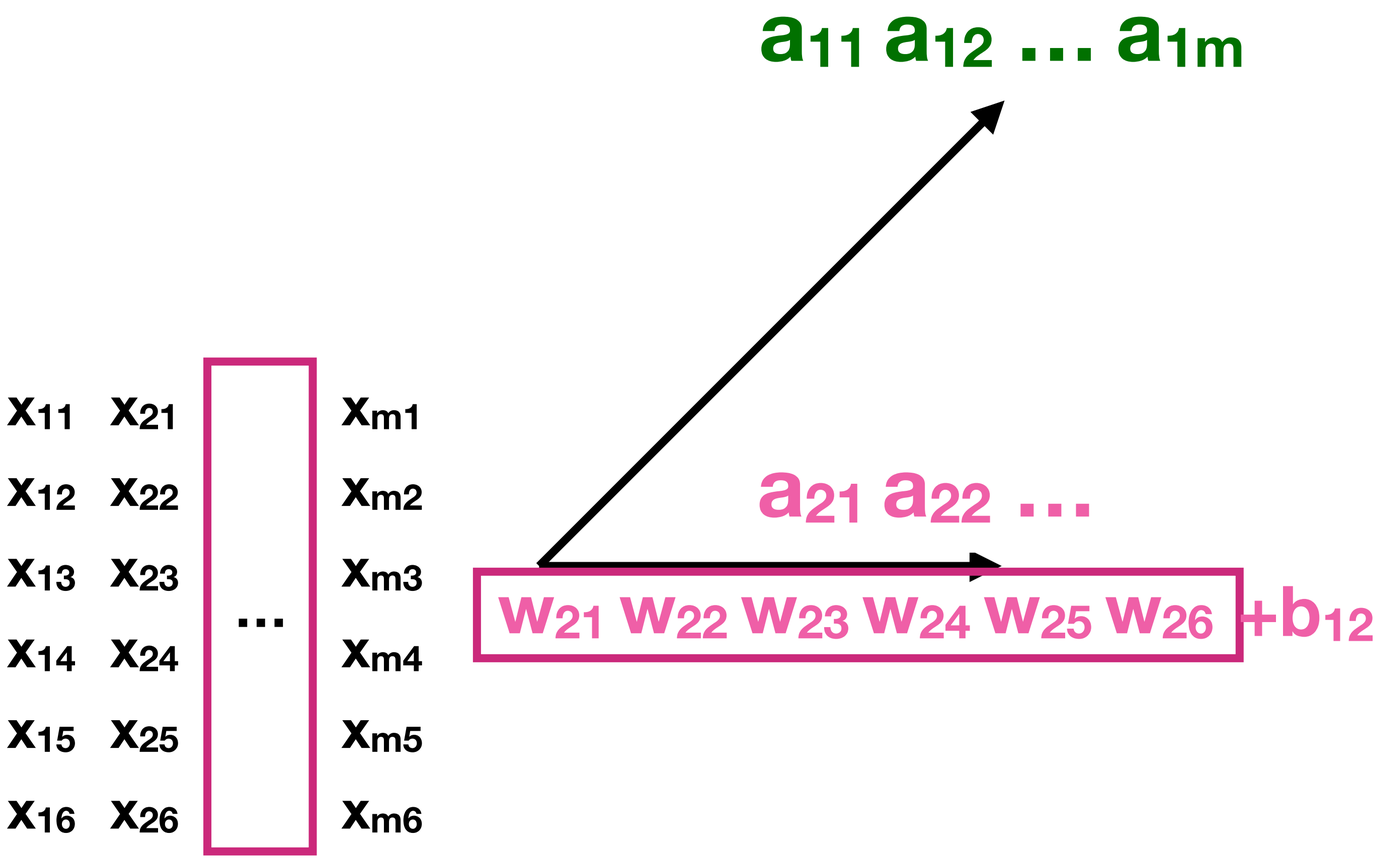

a11 a12 ... a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
...
w21 w22 w23 w24 w25 w26
+b12

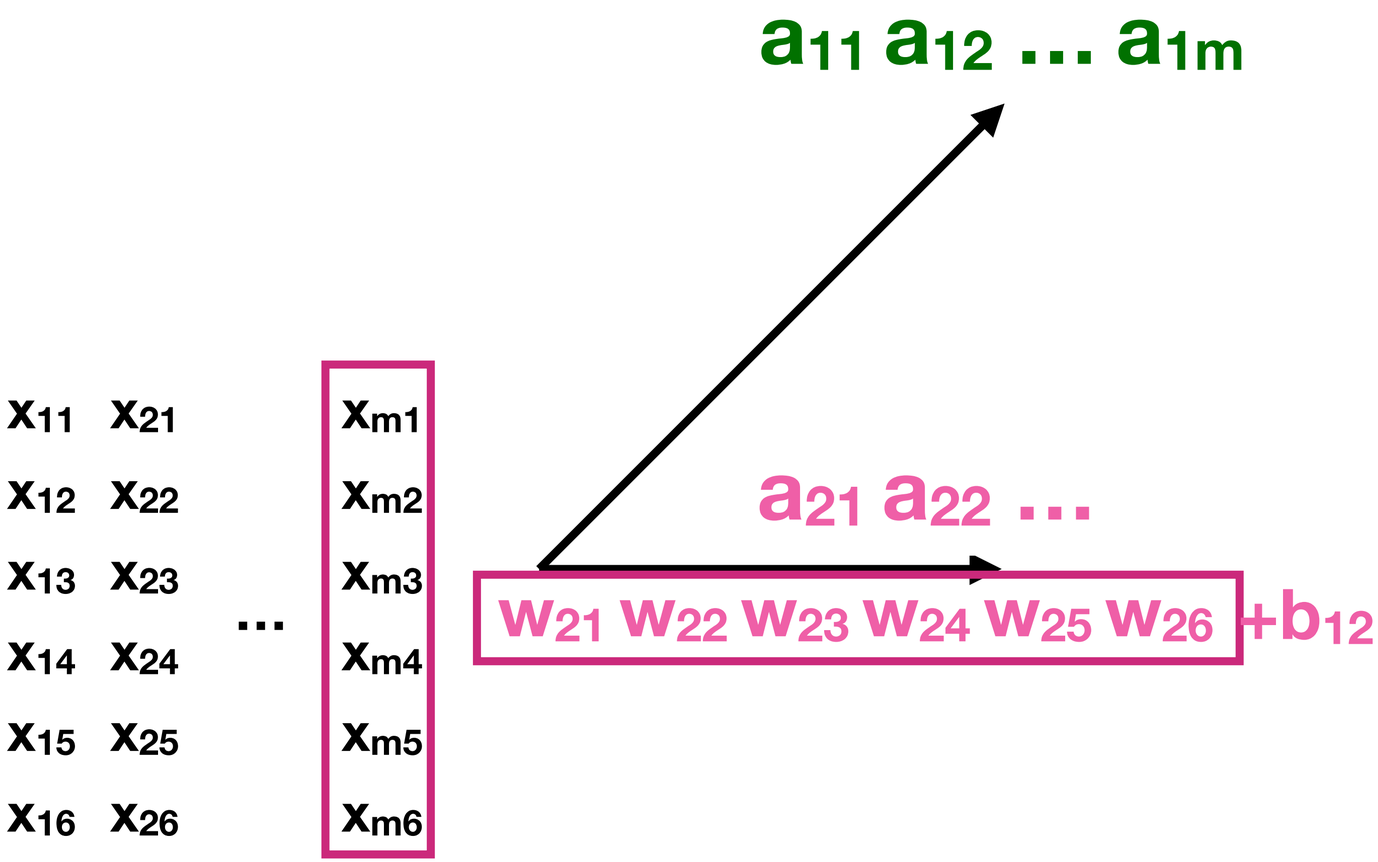

a11 a12 ... a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
... xm4
x14 x24
x15 x25 xm5
x16 x26 xm6
a21
w21 w22 w23 w24 w25 w26 +b12

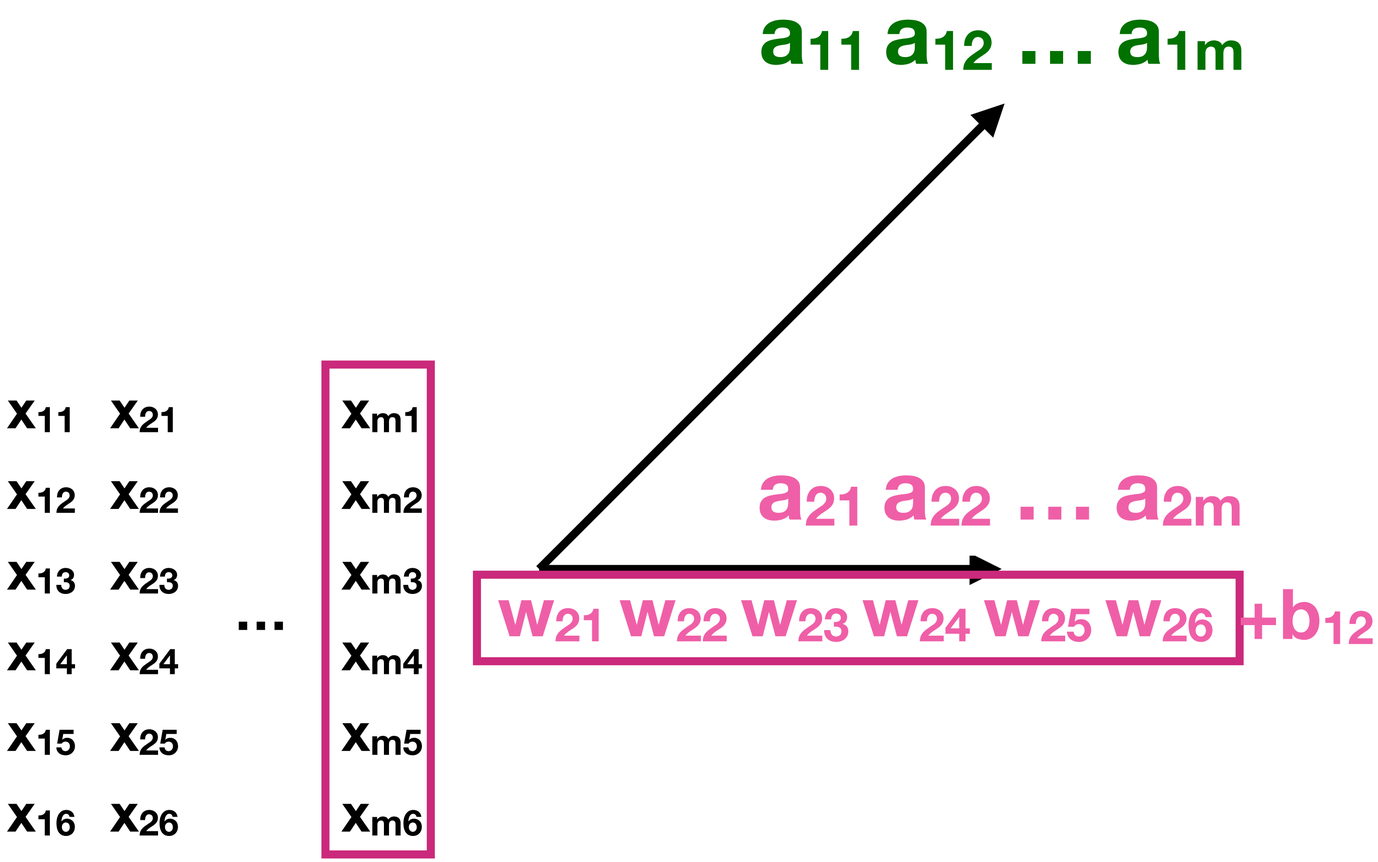

a11 a12 ... a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
... xm4
x14 x24
x15 x25 xm5
x16 x26 xm6
a21
w21 w22 w23 w24 w25 w26 +b12


a11 a12 ... a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
...
a21 a22
w21 w22 w23 w24 w25 w26 +b12

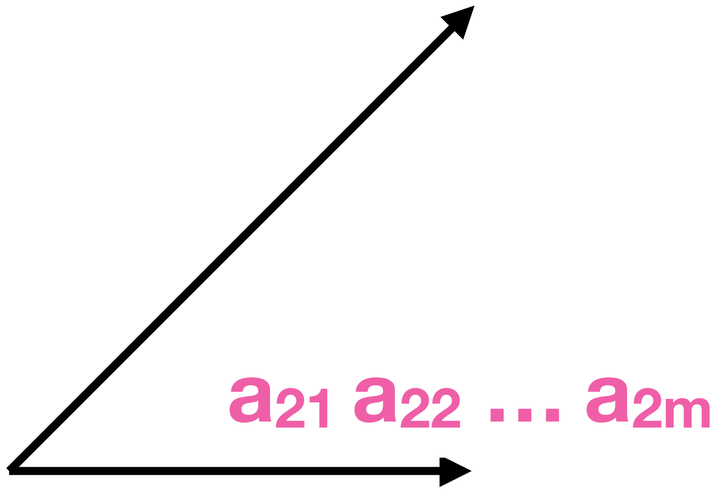

a11 a12 ... a1m
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
...
xm1
xm2
xm3
xm4
xm5
xm6
a21 a22
w21 w22 w23 w24 w25 w26
+b12


a11 a12 ... a1m
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
...
xm1
xm2
xm3
xm4
xm5
xm6
a21 a22 ...
w21 w22 w23 w24 w25 w26
+b12


a11 a12 ... a1m
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
...
xm1
xm2
xm3
xm4
xm5
xm6
a21 a22 ...
w21 w22 w23 w24 w25 w26
+b12


a11 a12 ... a1m
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
...
xm1
xm2
xm3
xm4
xm5
xm6
a21 a22 ... a2m
w21 w22 w23 w24 w25 w26
+b12

$a_{11}\ a_{12}\ \ldots\ a_{1m}$



$a_{21}\ a_{22}\ \ldots\ a_{2m}$

$x_{11}\ x_{21}\ \ldots\ x_{m1}$

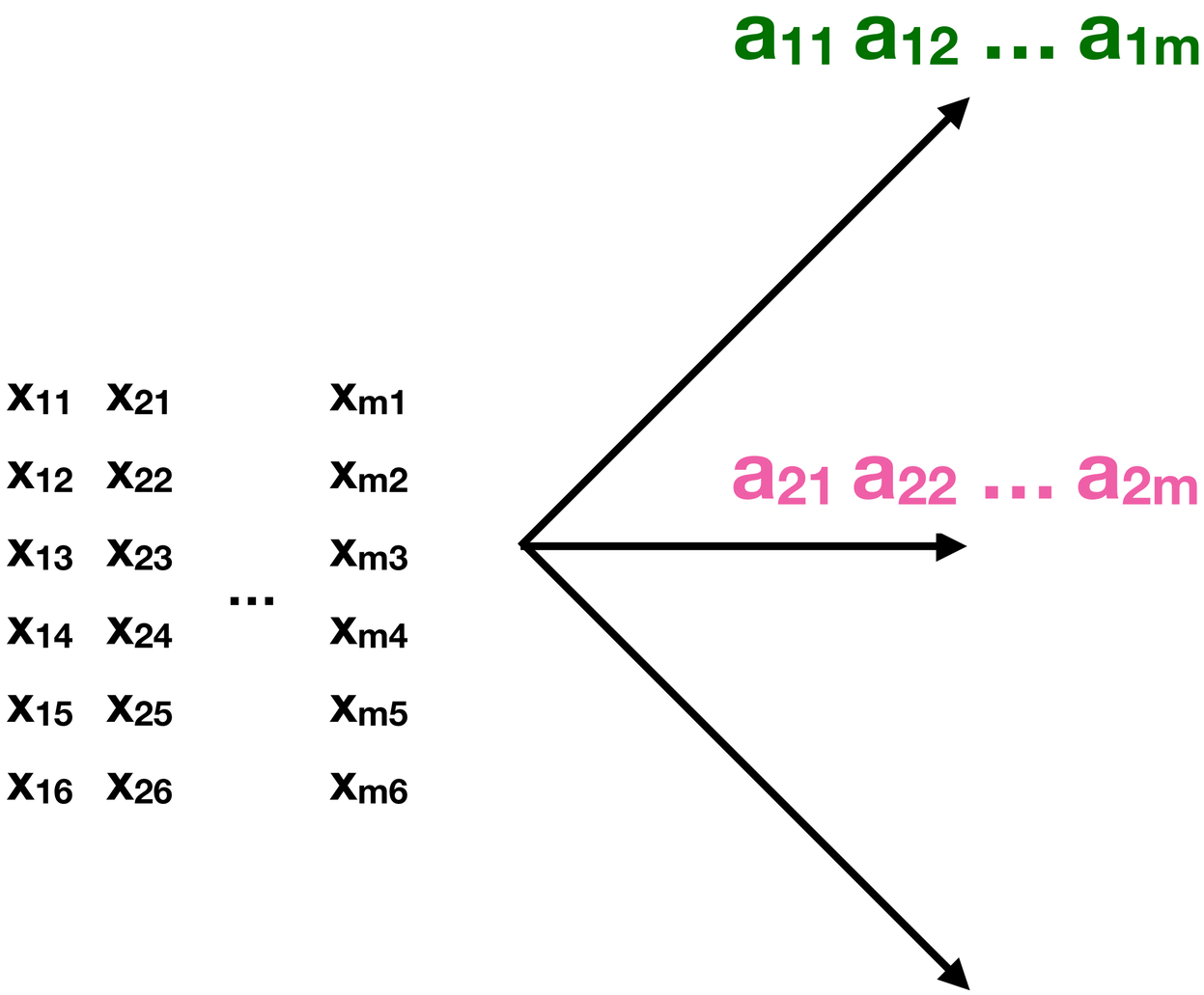
$x_{12}\ x_{22}\ \ldots\ x_{m2}$

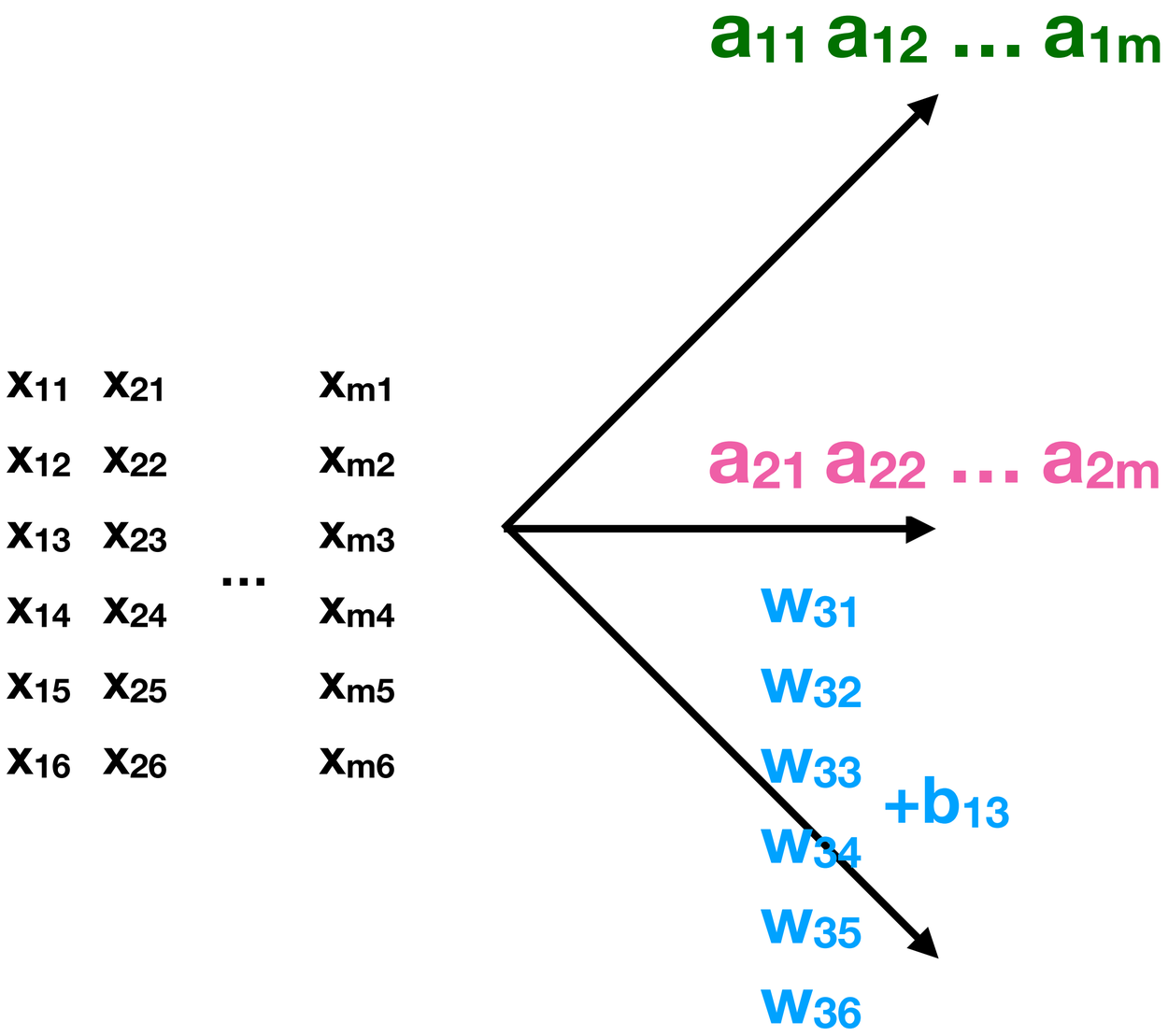
$x_{13}\ x_{23}\ \ldots\ x_{m3}$

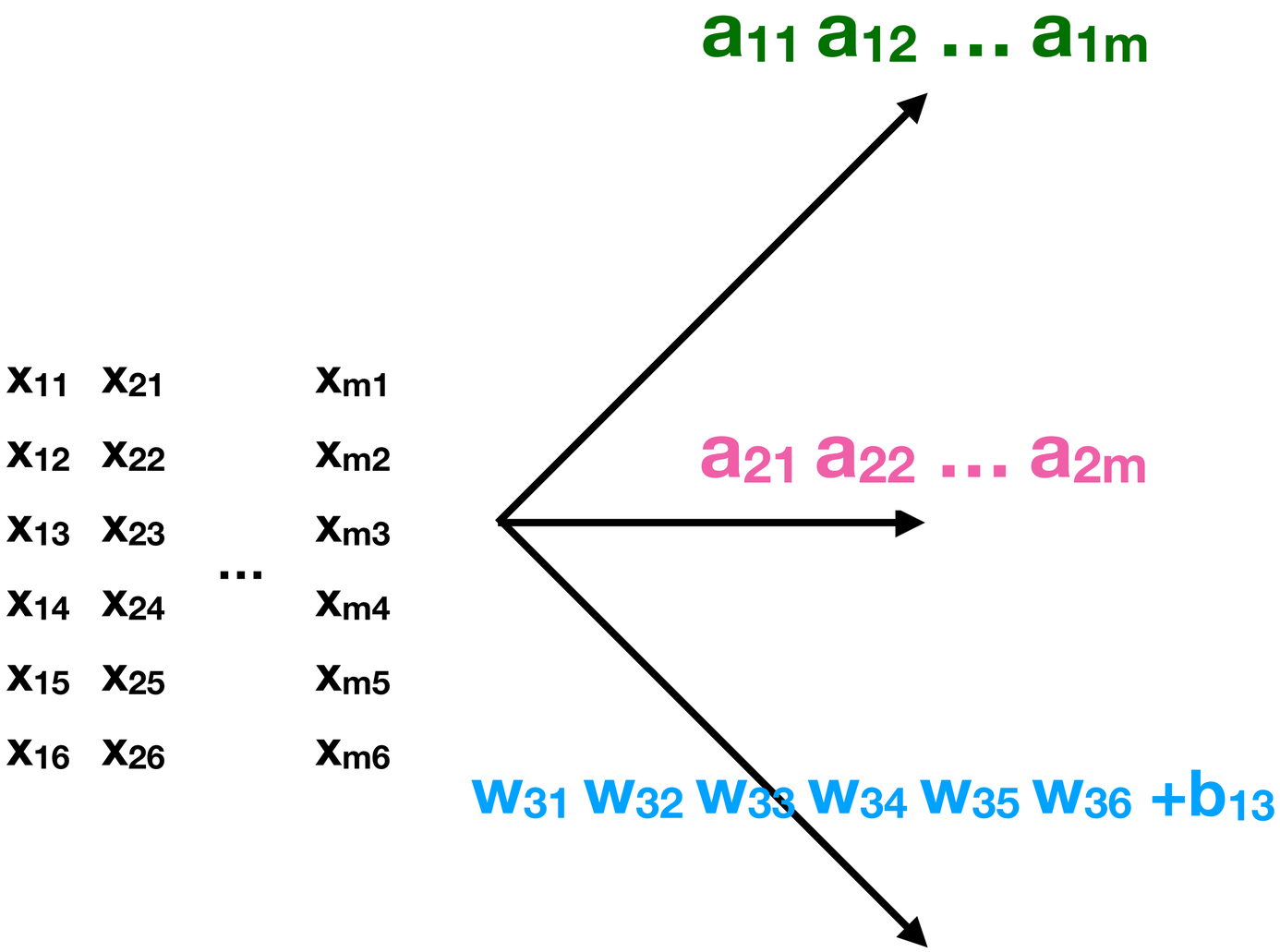
$x_{14}\ x_{24}\ \ldots\ x_{m4}$

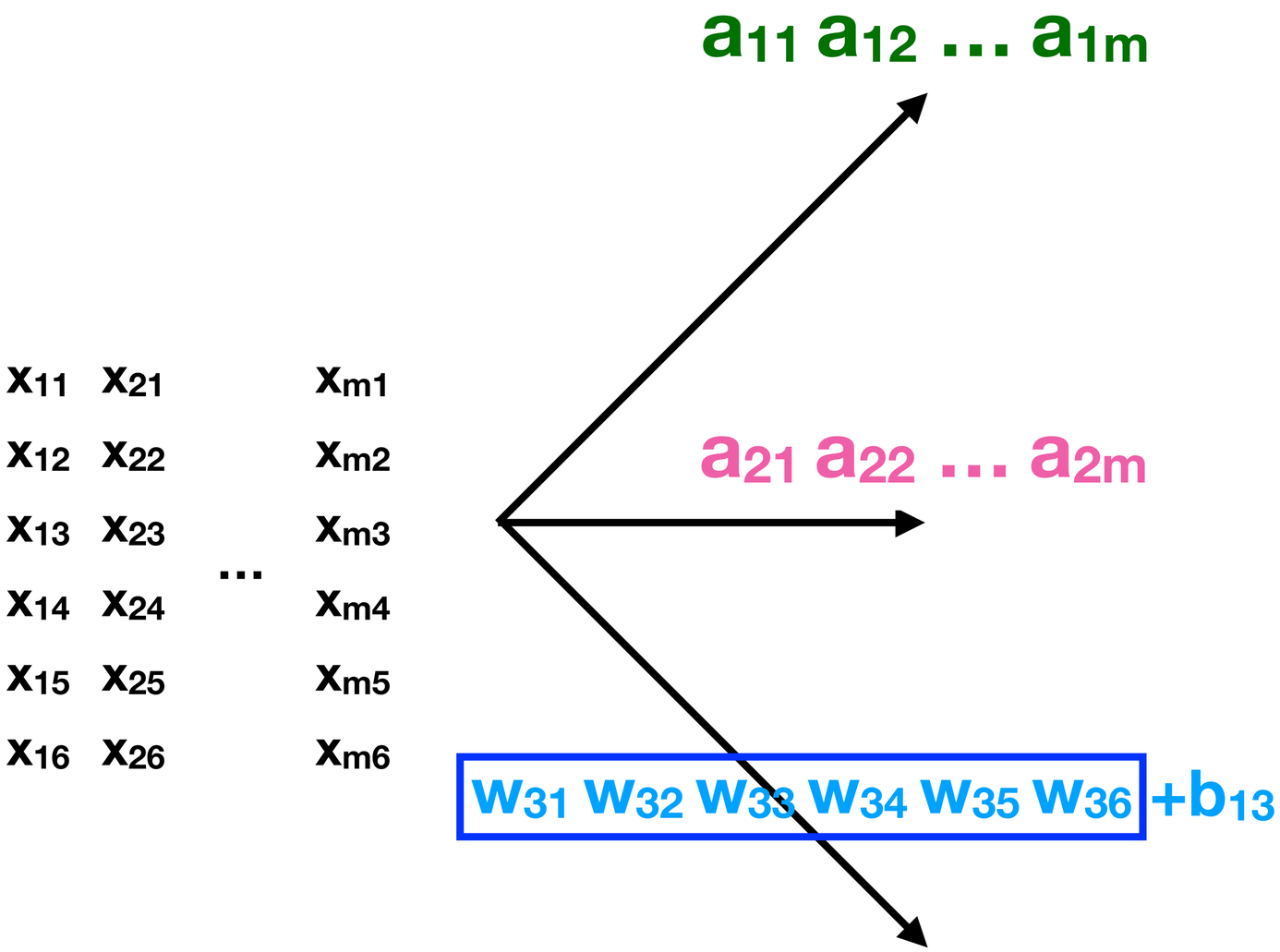
$x_{15}\ x_{25}\ \ldots\ x_{m5}$

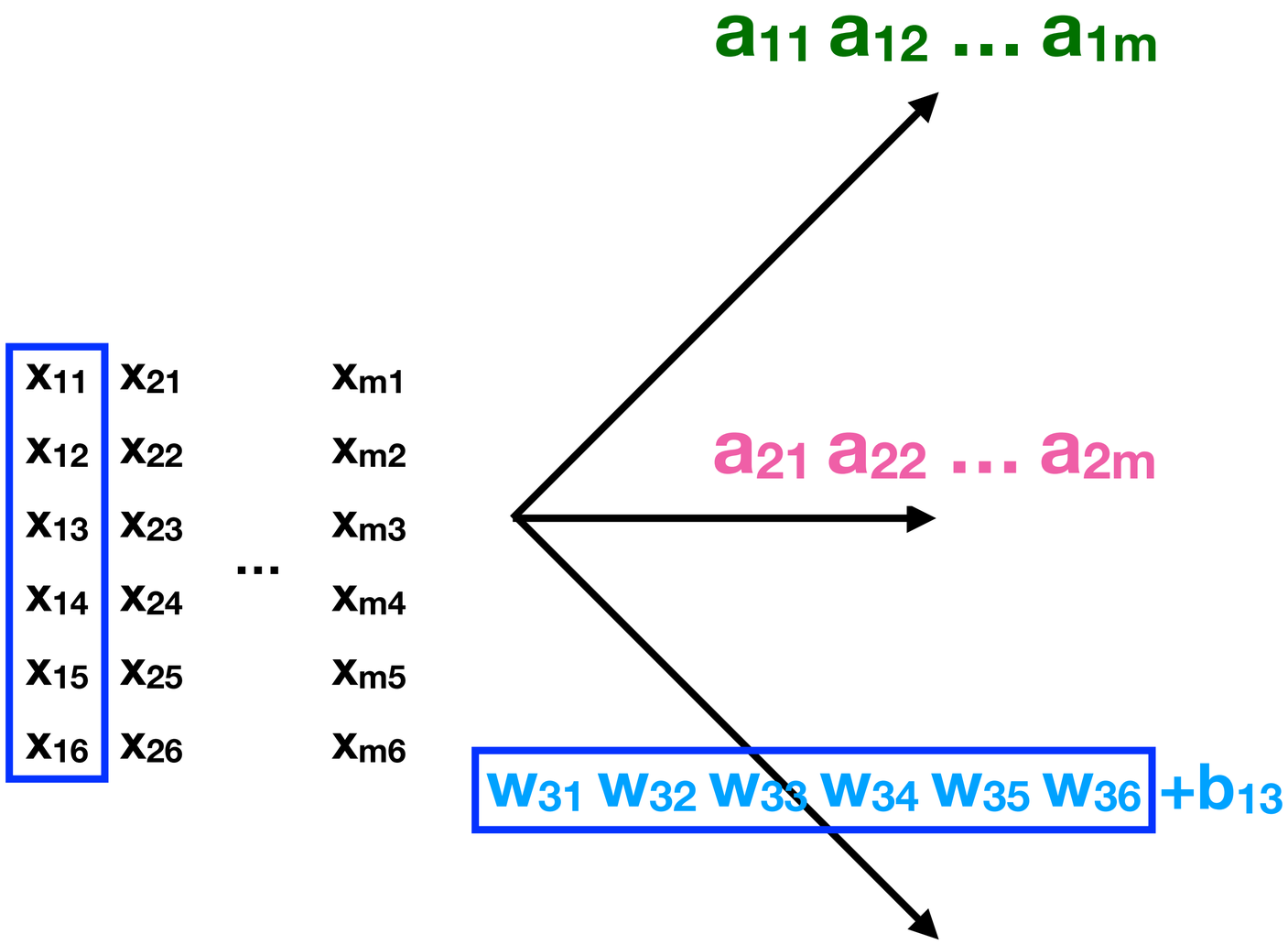
$x_{16}\ x_{26}\ \ldots\ x_{m6}$

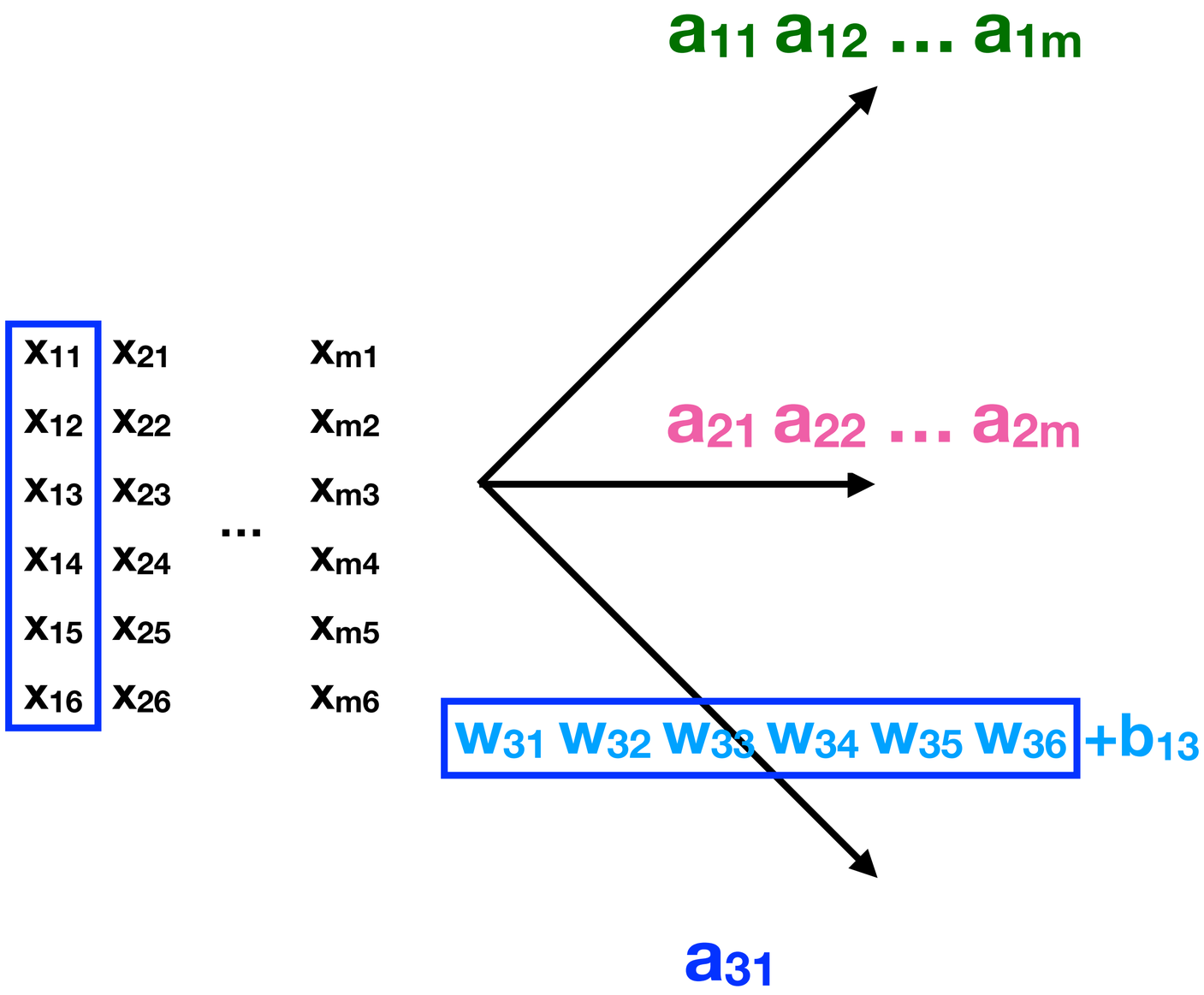

a11 a12 ... a1m
a21 a22 ... a2m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6

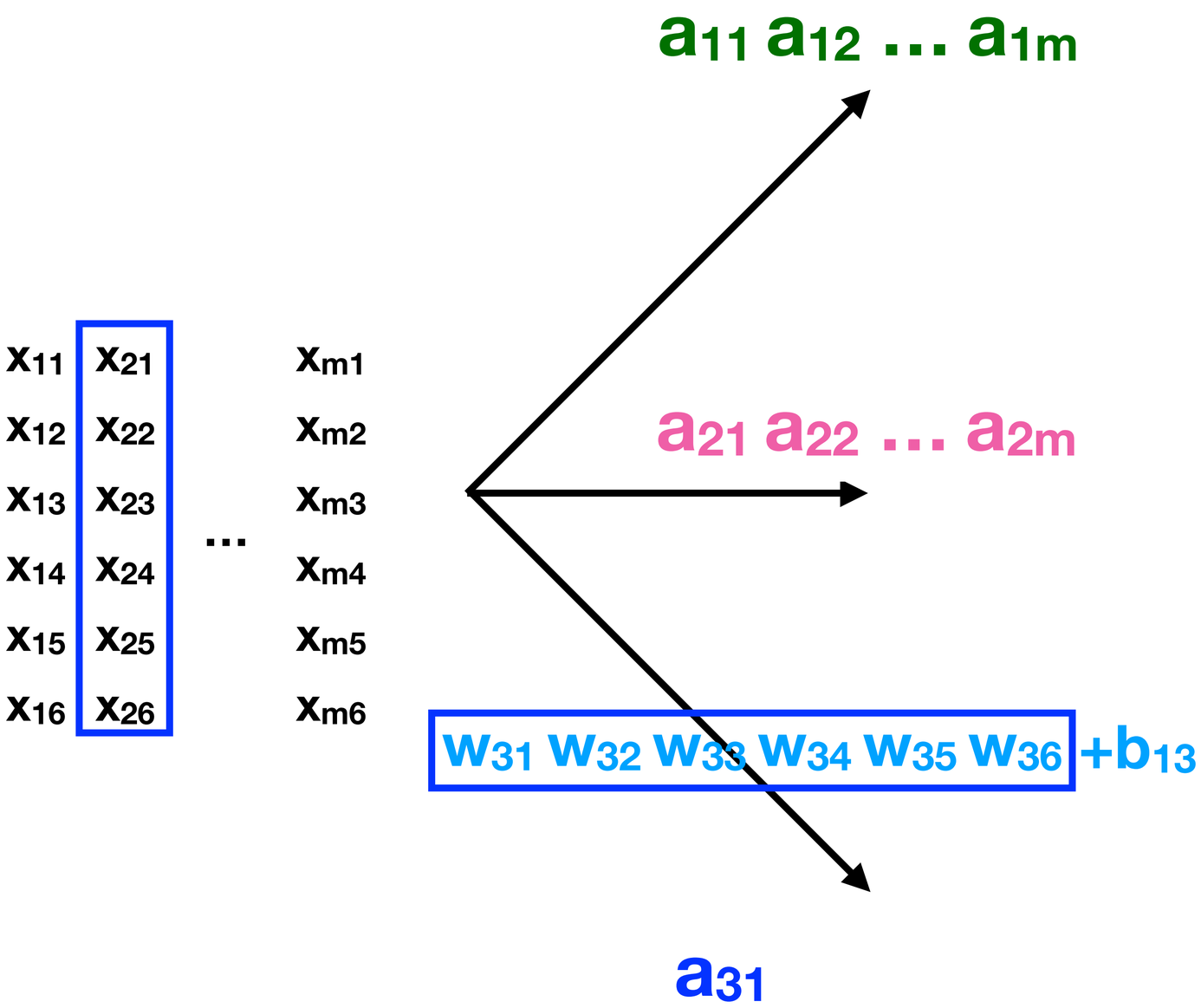

a11 a12 ... a1m
a21 a22 ... a2m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w31
w32
w33
+b13
w34
w35
w36

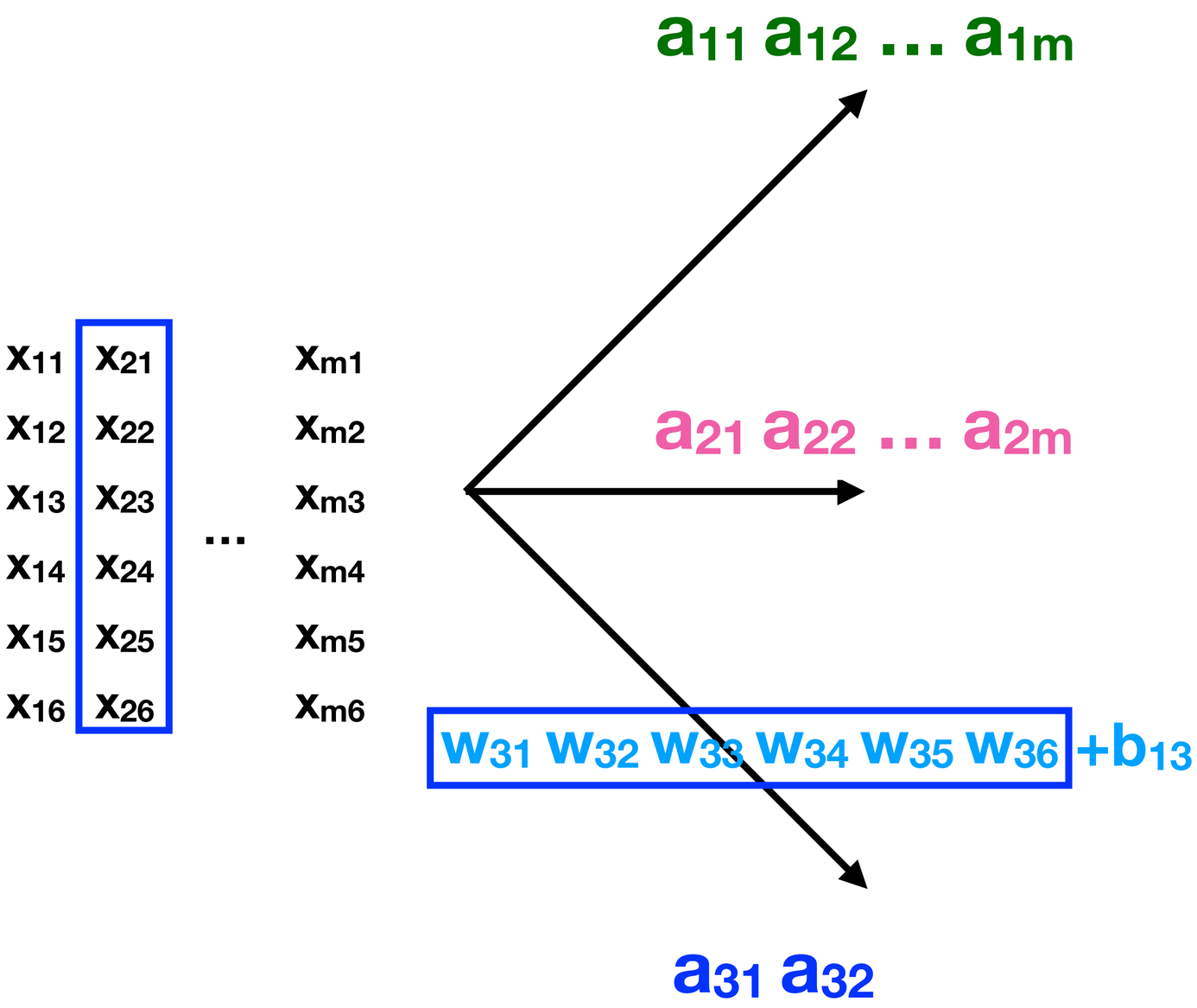

a_{11} a_{12} … a_{1m}
a_{21} a_{22} … a_{2m}
w_{31} w_{32} w_{33} w_{34} w_{35} w_{36} $+b_{13}$
x_{11} x_{21} x_{m1}
x_{12} x_{22} x_{m2}
x_{13} x_{23} x_{m3}
…
x_{14} x_{24} x_{m4}
x_{15} x_{25} x_{m5}
x_{16} x_{26} x_{m6}

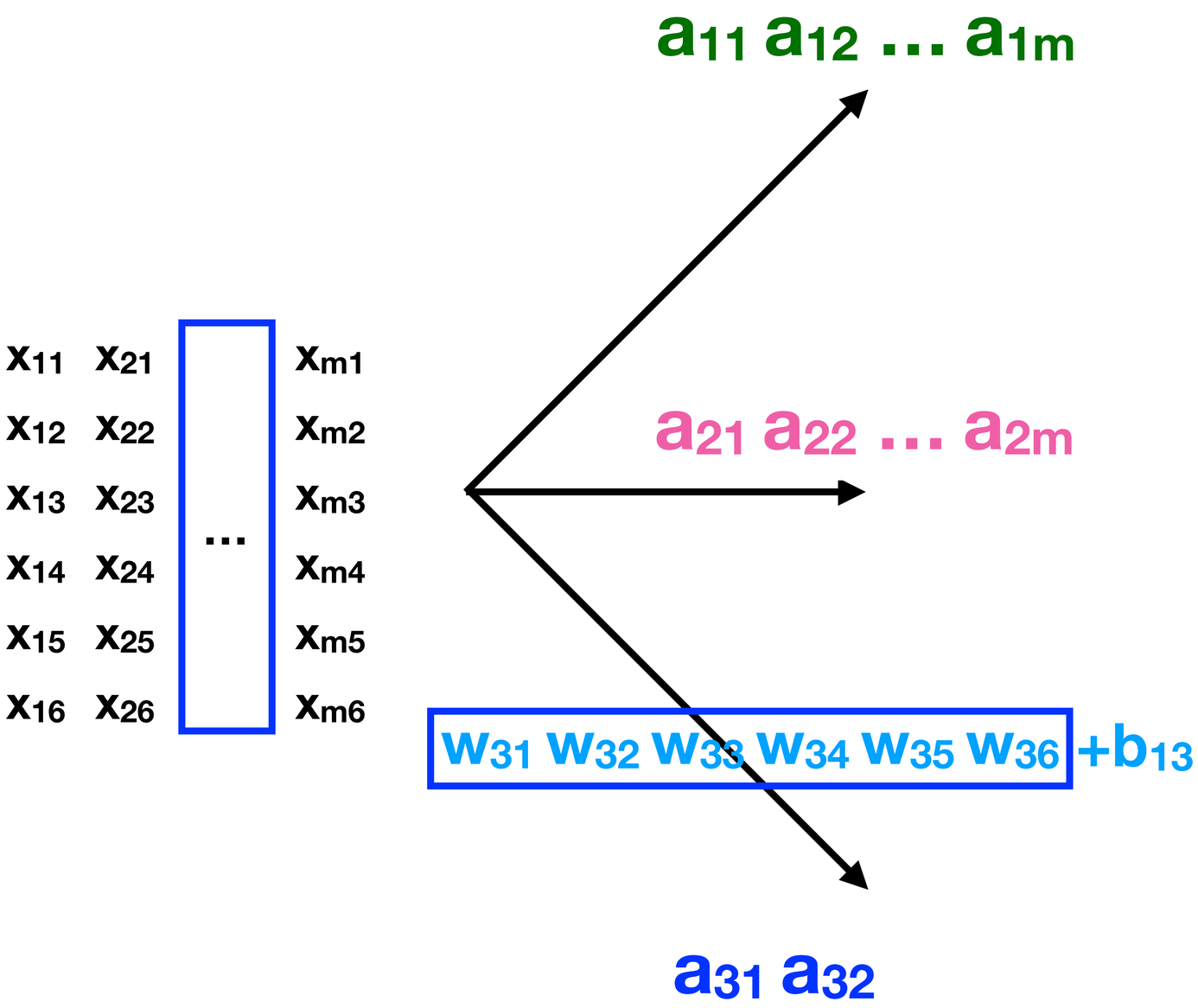

a11 a12 ... a1m
a21 a22 ... a2m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w31 w32 w33 w34 w35 w36 +b13

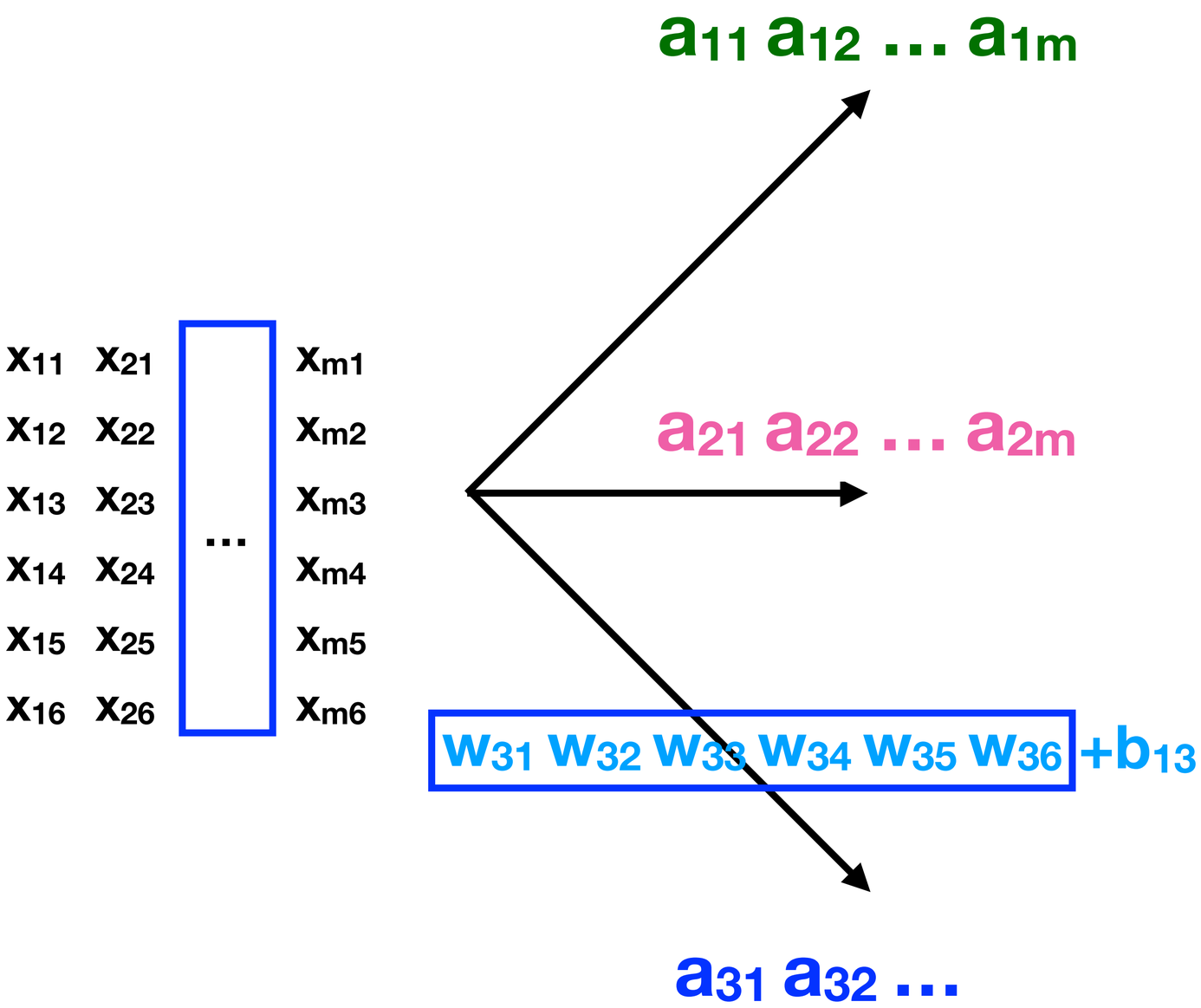

a11 a12 ... a1m
a21 a22 ... a2m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w31 w32 w33 w34 w35 w36 +b13

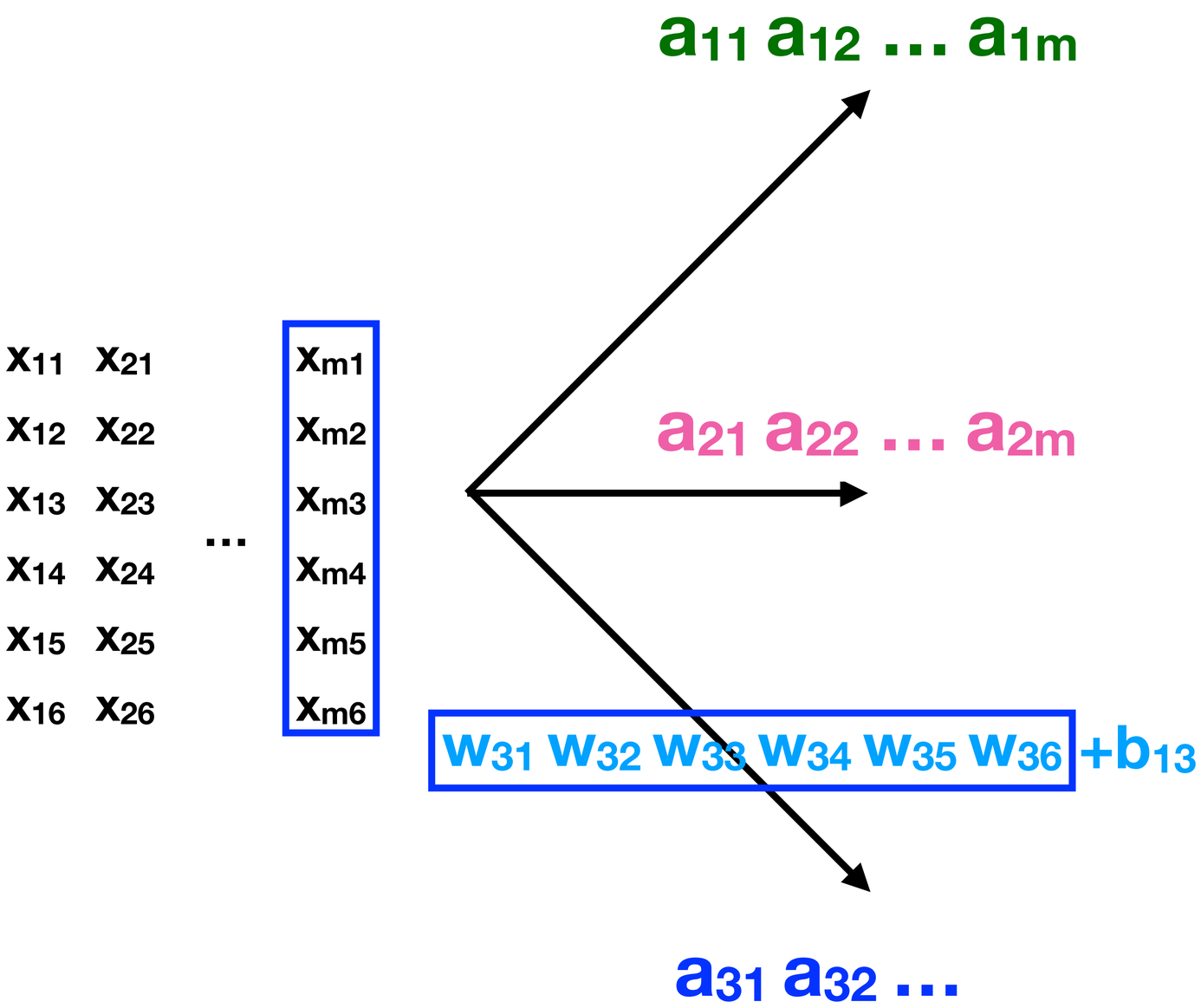

a11 a12 ... a1m
a21 a22 ... a2m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w31 w32 w33 w34 w35 w36 +b13
a31

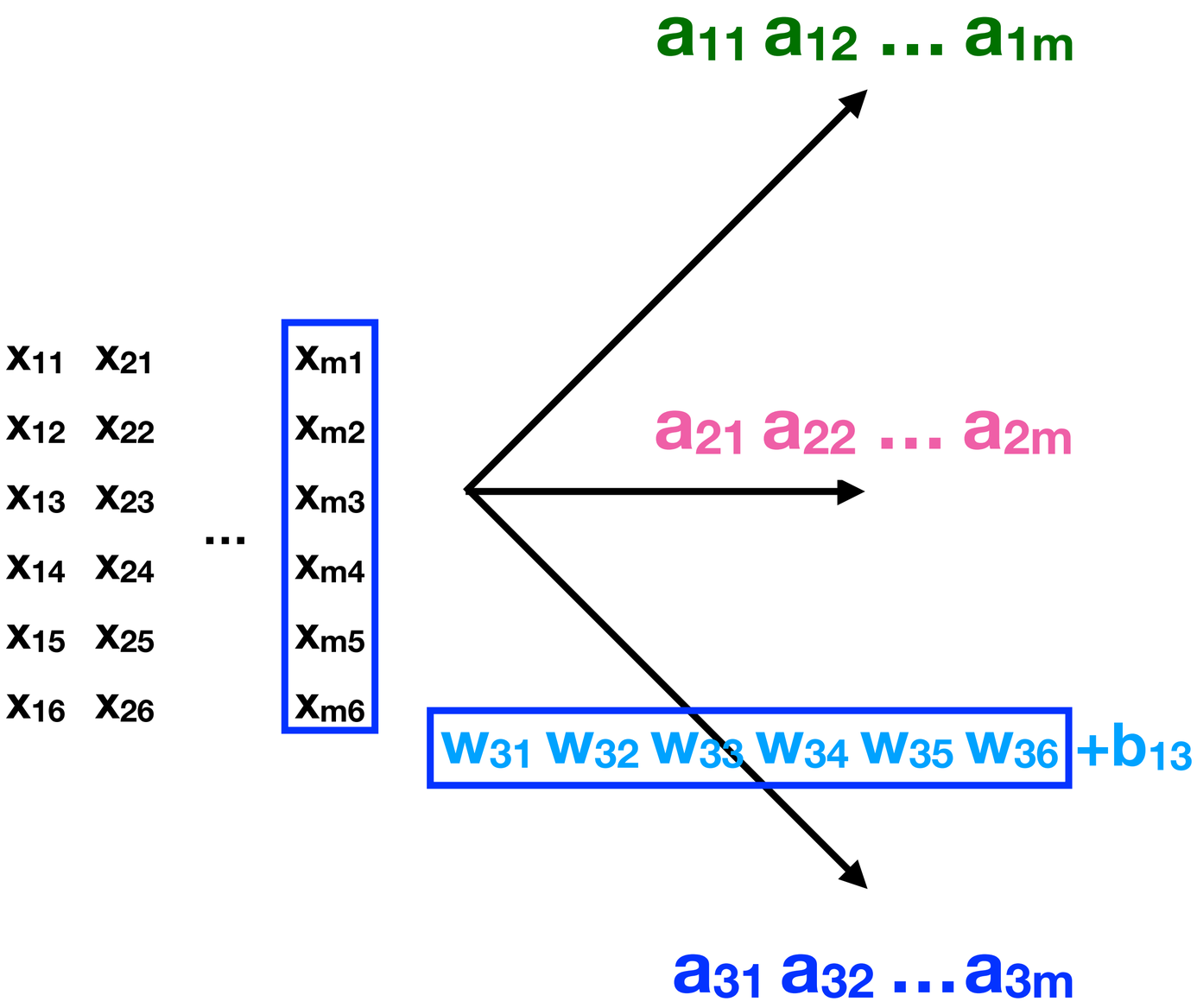

a11 a12 ... a1m
a21 a22 ... a2m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
...
w31 w32 w33 w34 w35 w36 +b13
a31

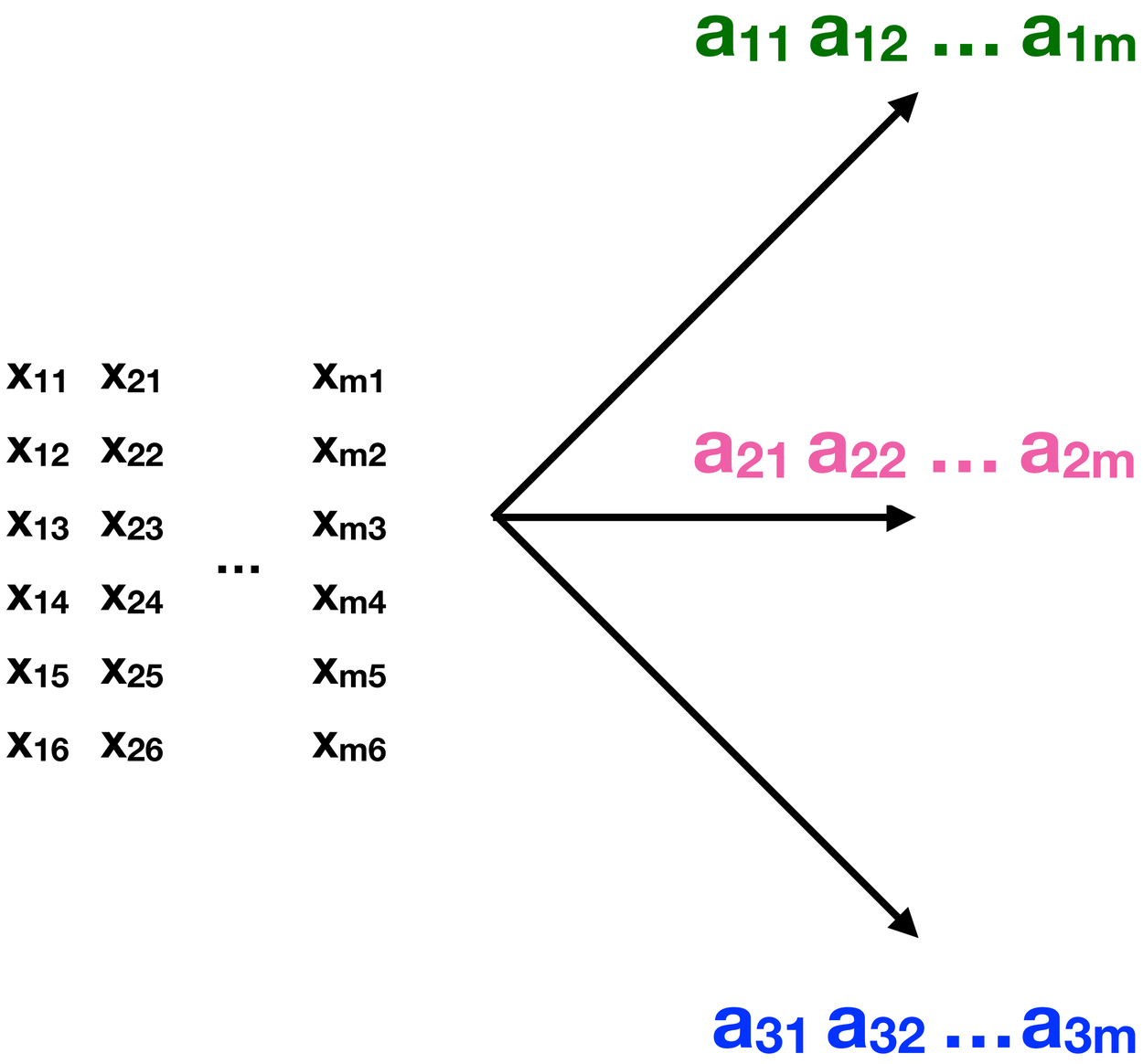

a11 a12 ... a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
...
a21 a22 ... a2m
w31 w32 w33 w34 w35 w36 +b13
a31 a32

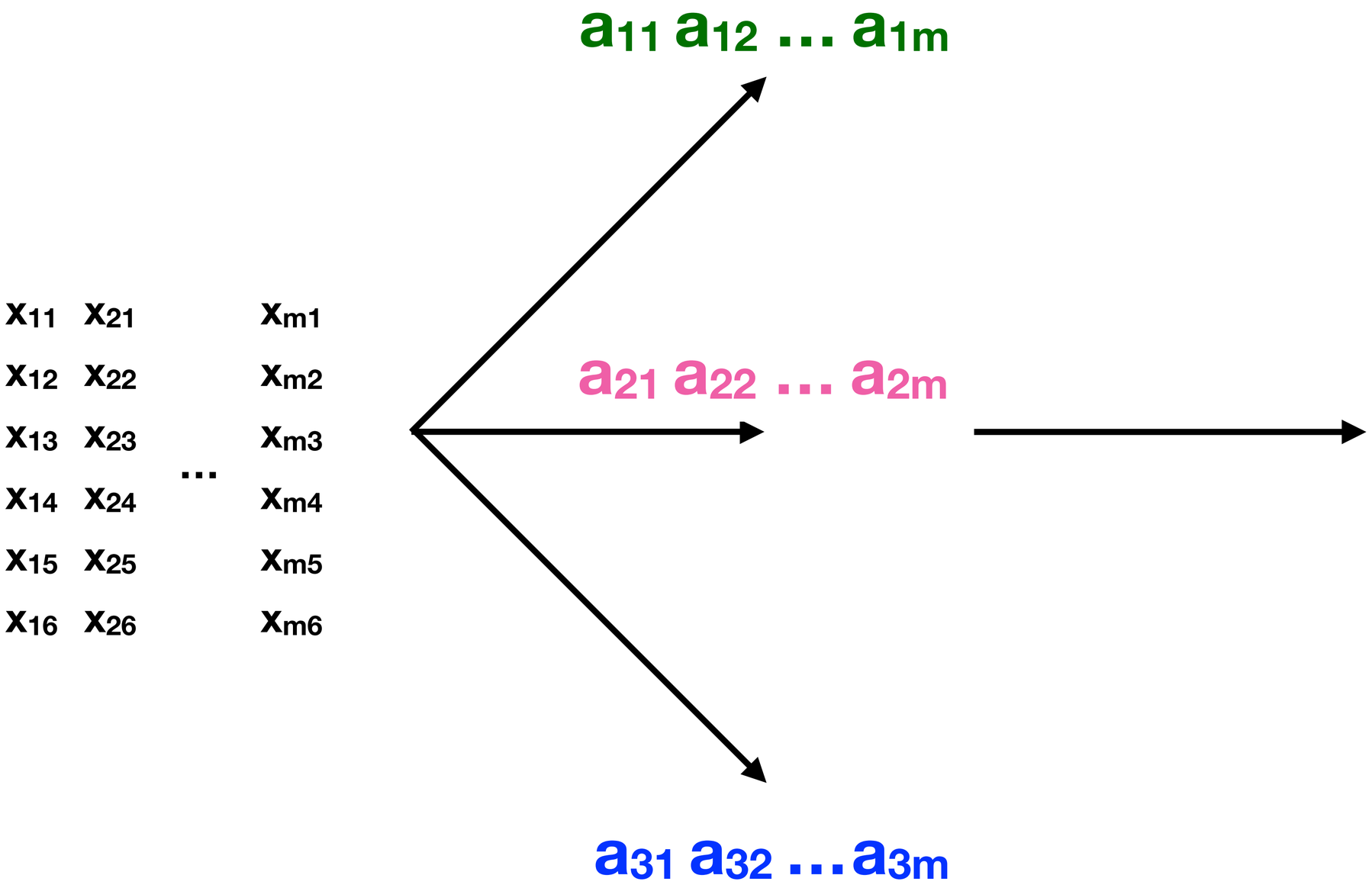

a11 a12 ... a1m
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
...
xm1
xm2
xm3
xm4
xm5
xm6
a21 a22 ... a2m
w31 w32 w33 w34 w35 w36 +b13
a31 a32

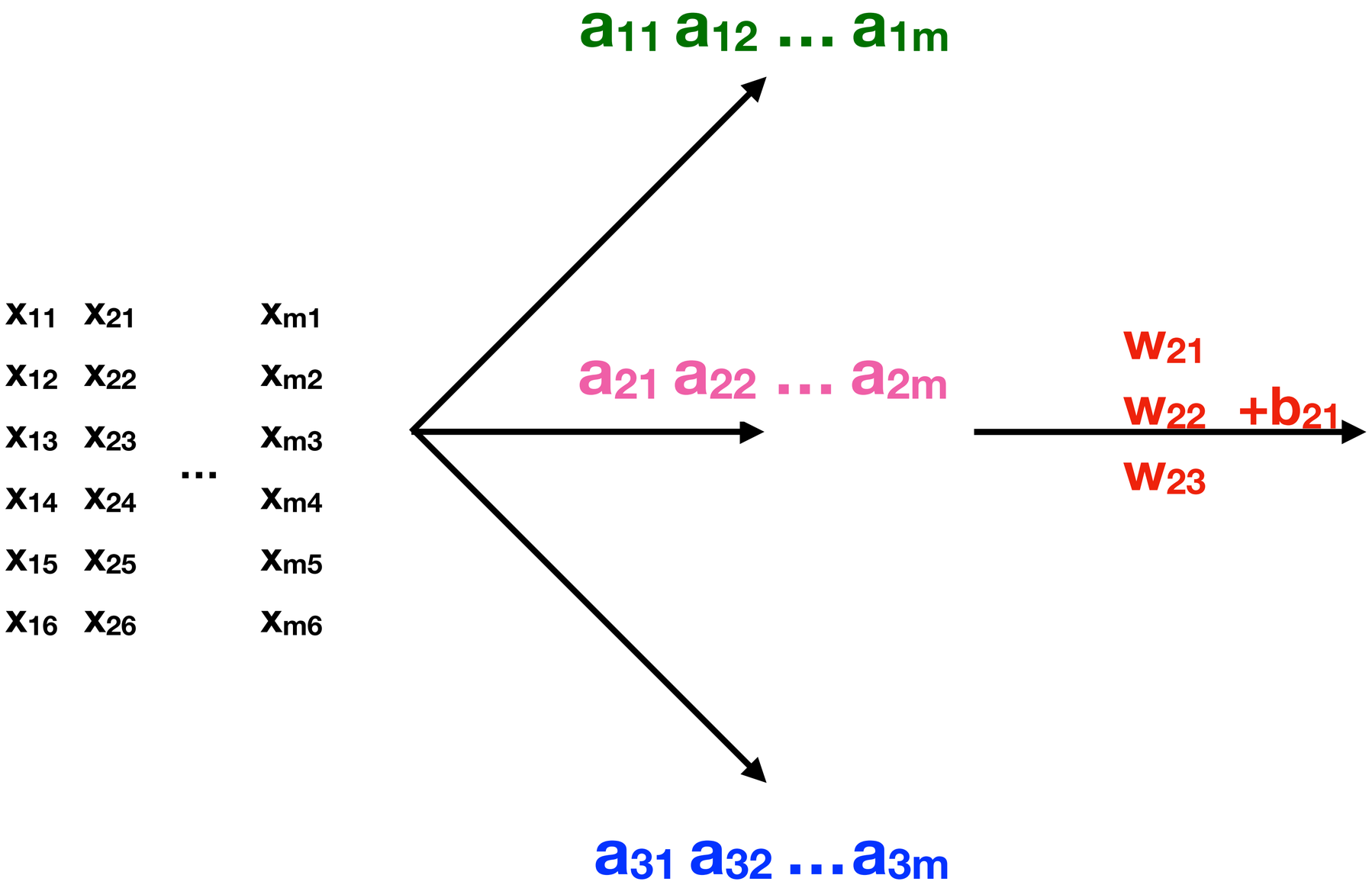

a11 a12 … a1m
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
…
xm1
xm2
xm3
xm4
xm5
xm6
a21 a22 … a2m
w31 w32 w33 w34 w35 w36 +b13
a31 a32 …

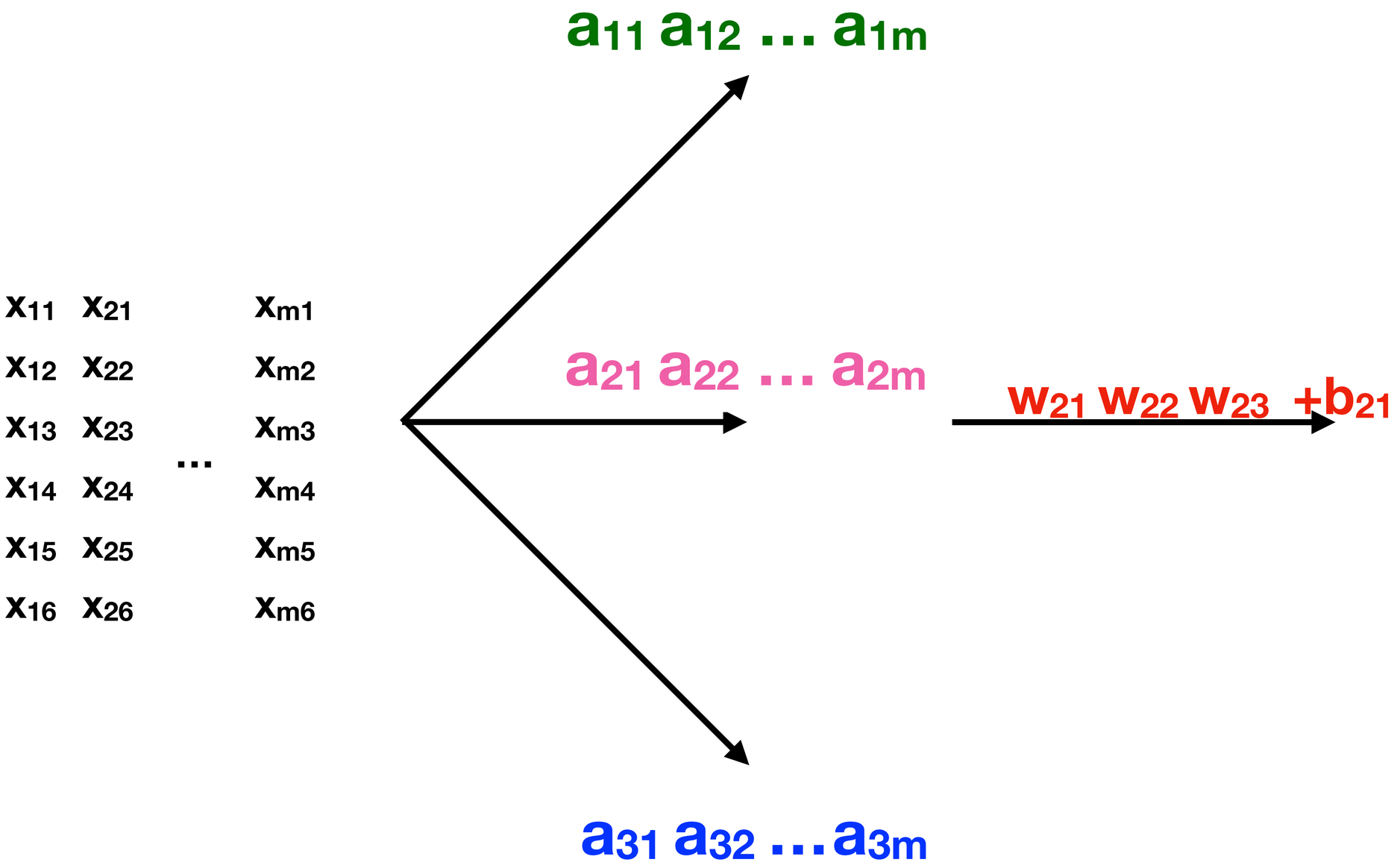

a11 a12 … a1m
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
…
xm1
xm2
xm3
xm4
xm5
xm6
a21 a22 … a2m
w31 w32 w33 w34 w35 w36 +b13
a31 a32 …

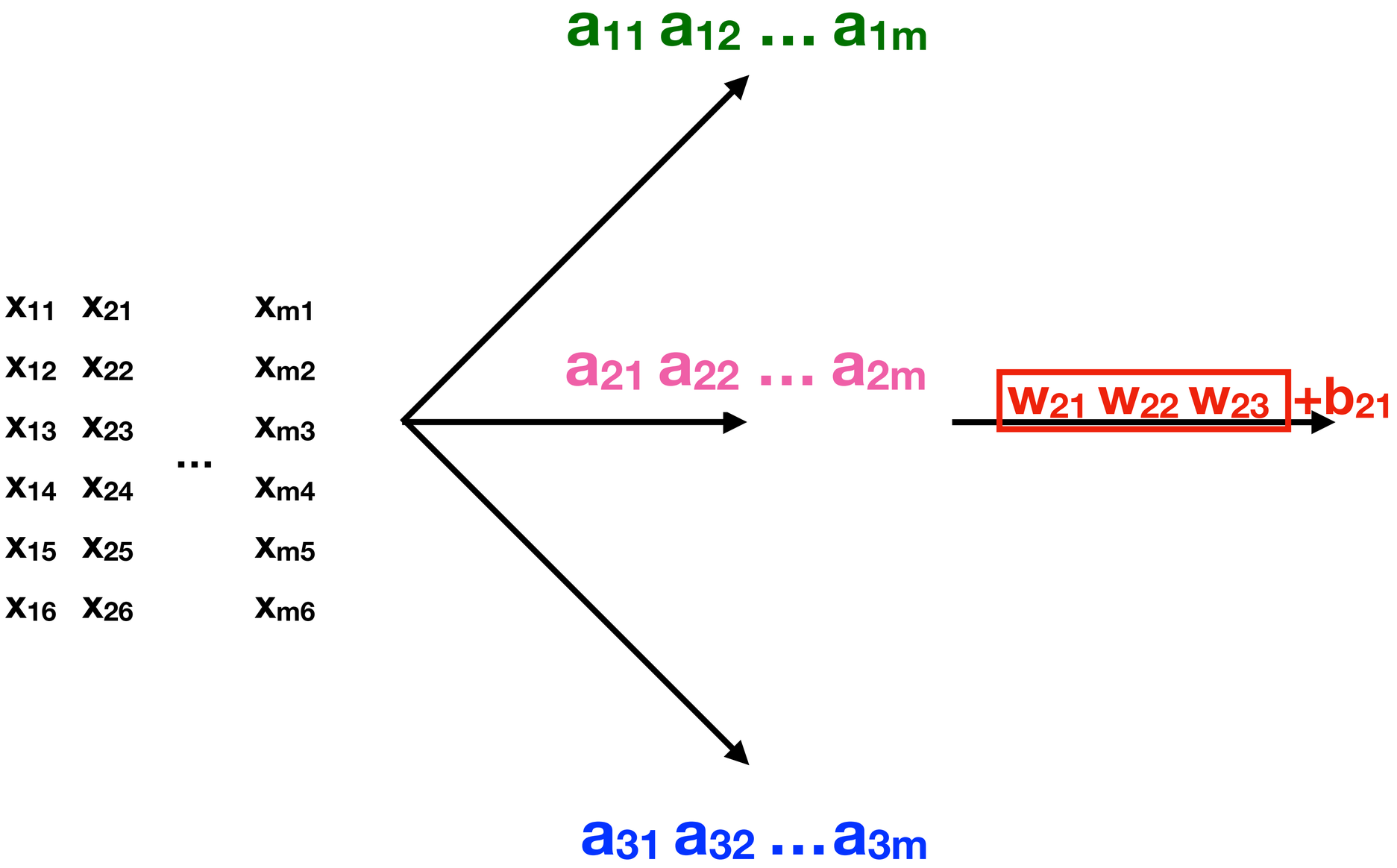

a11 a12 ... a1m
x11 x21
x12 x22
x13 x23
x14 x24
x15 x25
x16 x26
...
xm1
xm2
xm3
xm4
xm5
xm6
a21 a22 ... a2m
w31 w32 w33 w34 w35 w36 +b13
a31 a32 ...a3m

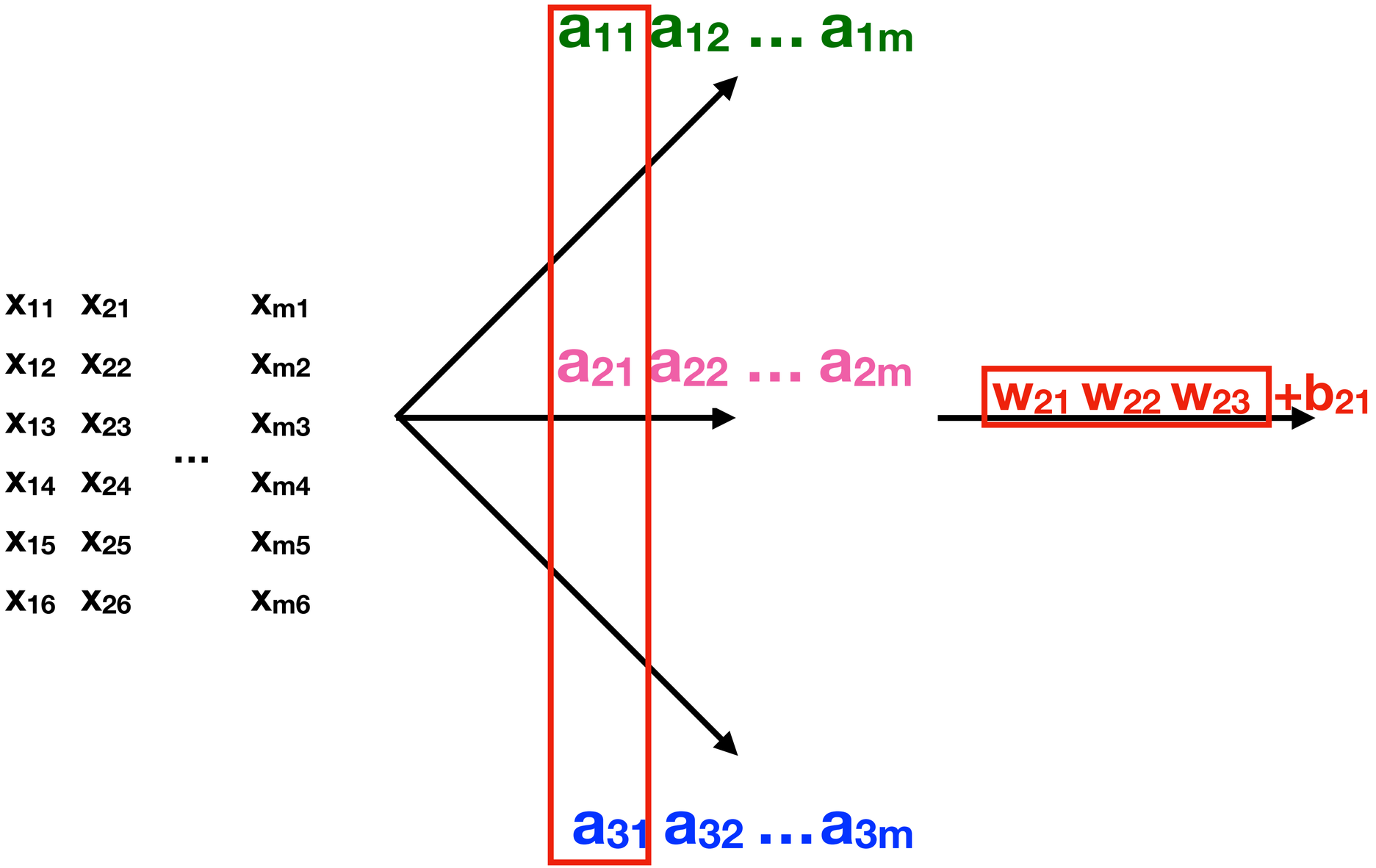

a11 a12 … a1m
a21 a22 … a2m
a31 a32 …a3m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
…
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6

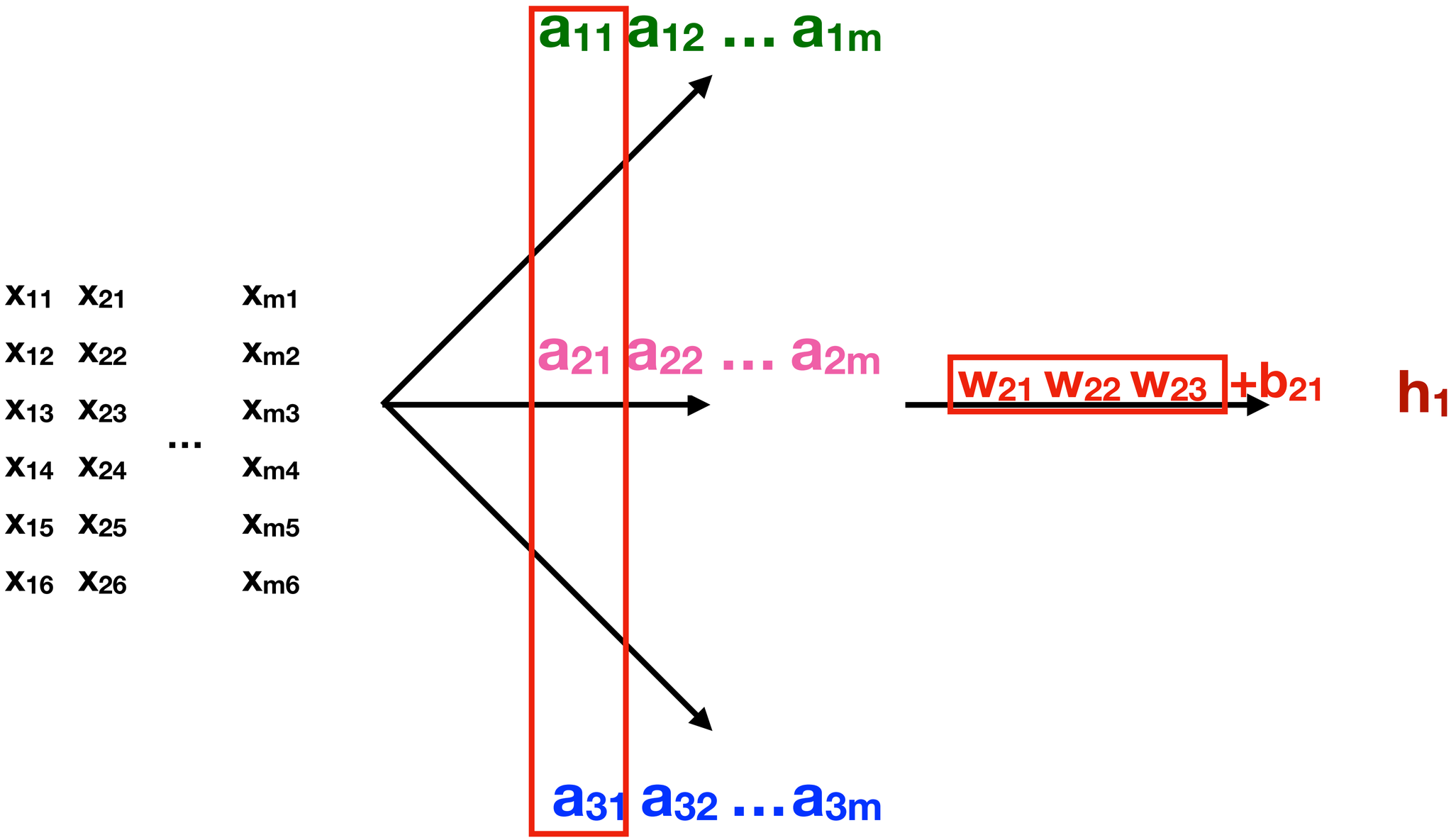

a11 a12 … a1m
a21 a22 … a2m
a31 a32 …a3m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
…
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6

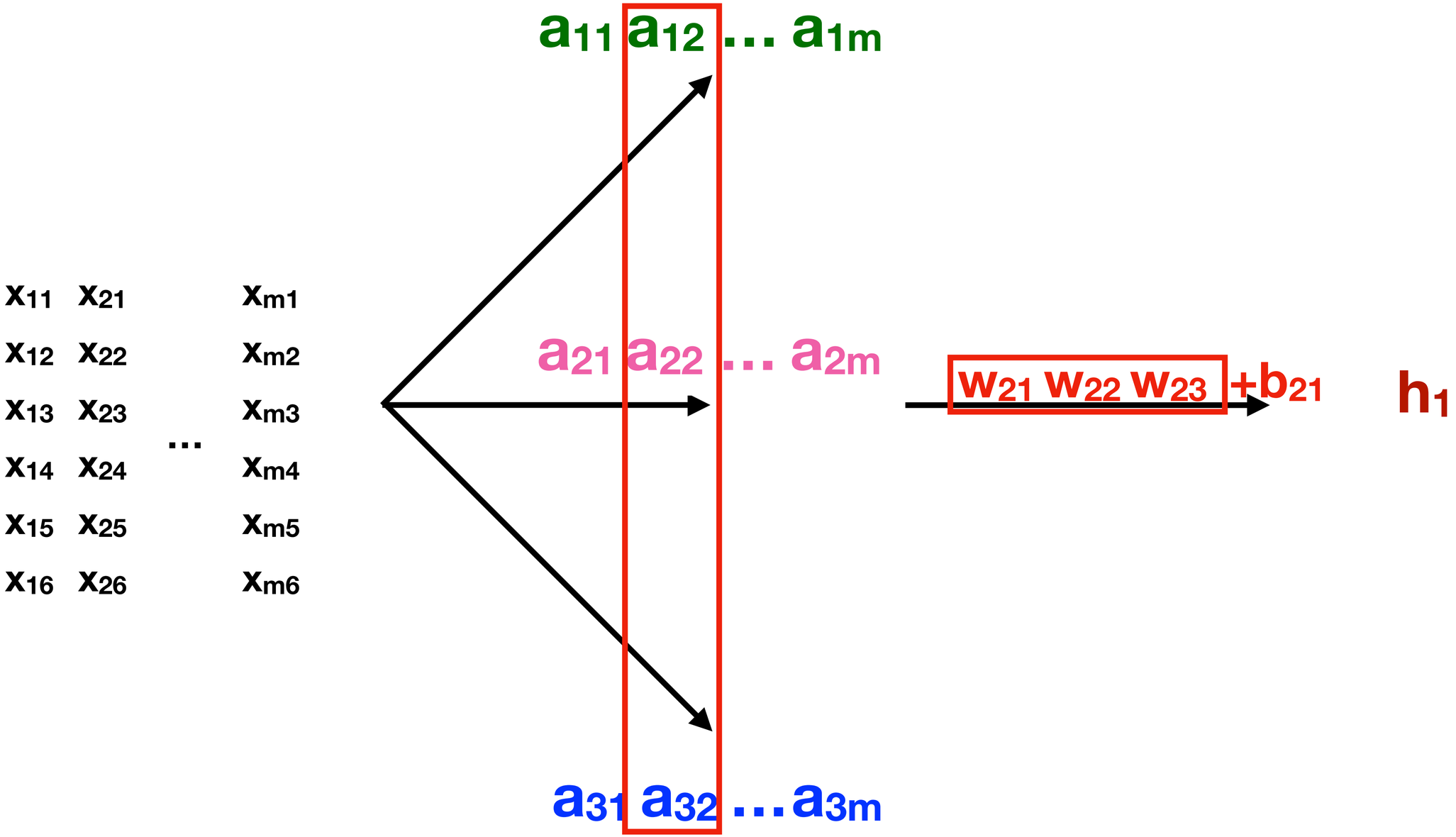

a_{11} a_{12} … a_{1m}
a_{21} a_{22} … a_{2m}
a_{31} a_{32} …a_{3m}
x_{11} x_{21} x_{m1}
x_{12} x_{22} x_{m2}
x_{13} x_{23} x_{m3}
…
x_{14} x_{24} x_{m4}
x_{15} x_{25} x_{m5}
x_{16} x_{26} x_{m6}
w_{21}
w_{22} $+b_{21}$
w_{23}

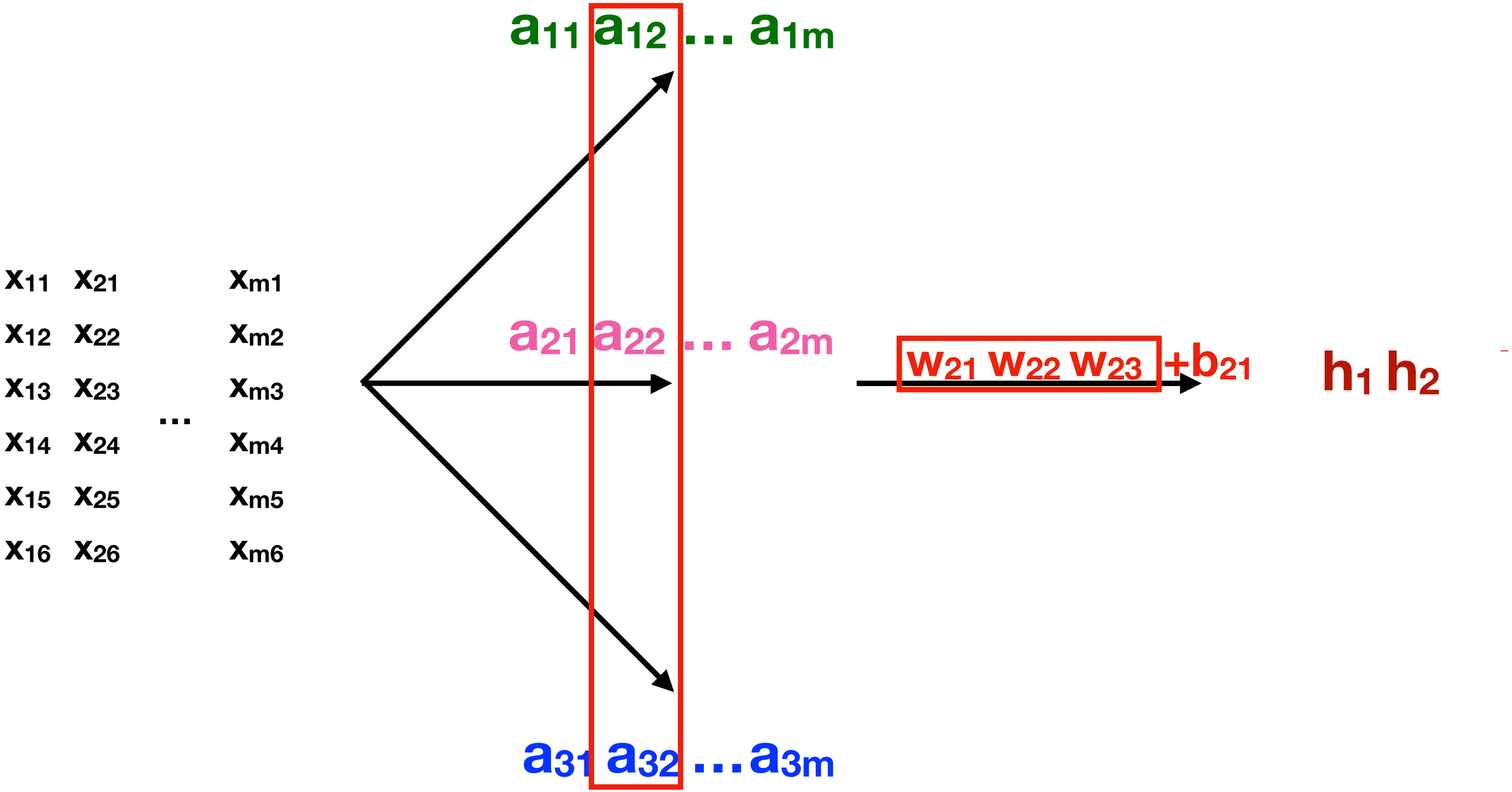

a11 a12 ... a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
a21 a22 ... a2m
w21 w22 w23 +b21
a31 a32 ...a3m

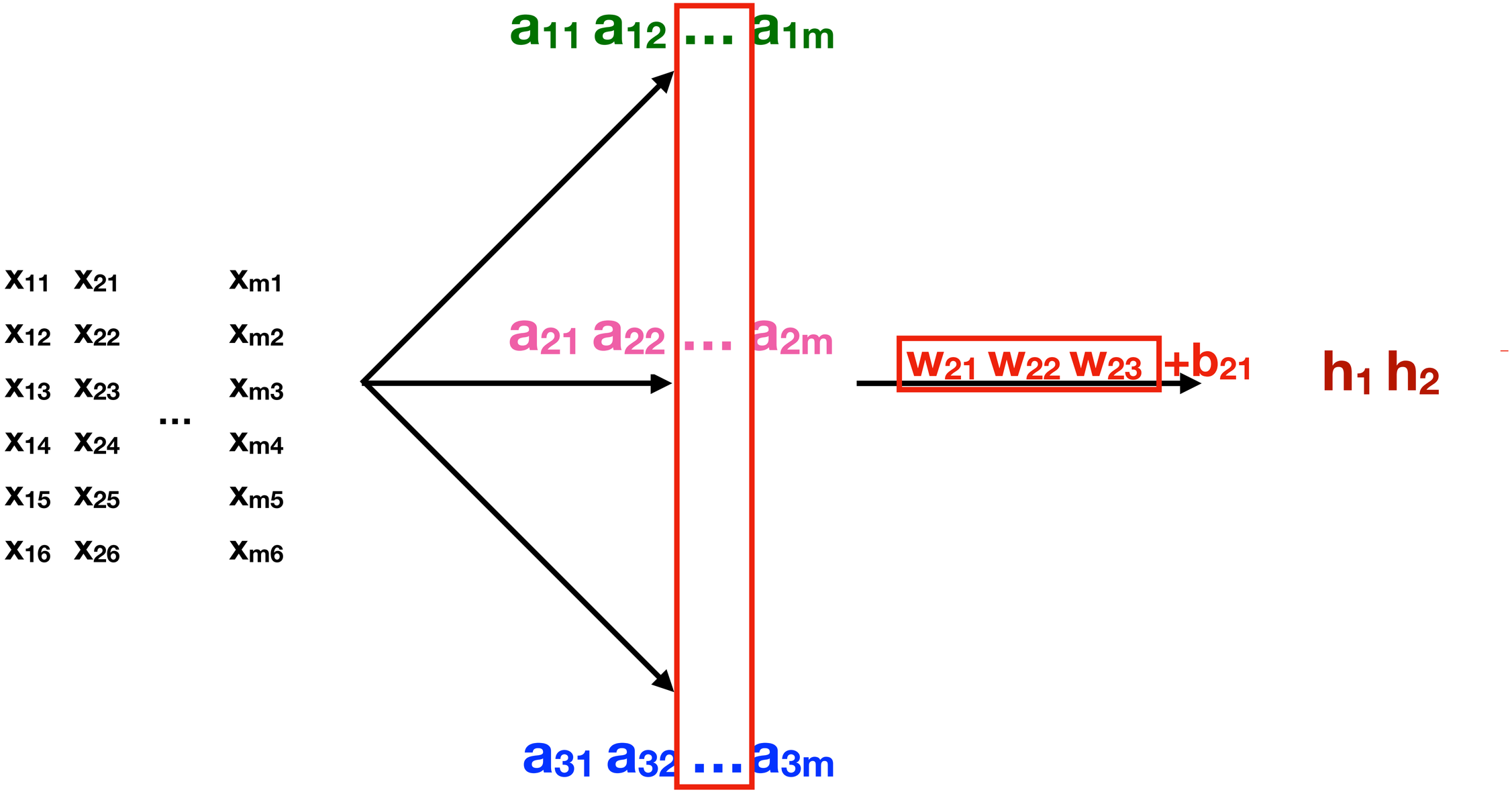

a11 a12 … a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
…
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
a21 a22 … a2m
w21 w22 w23 +b21
a31 a32 …a3m

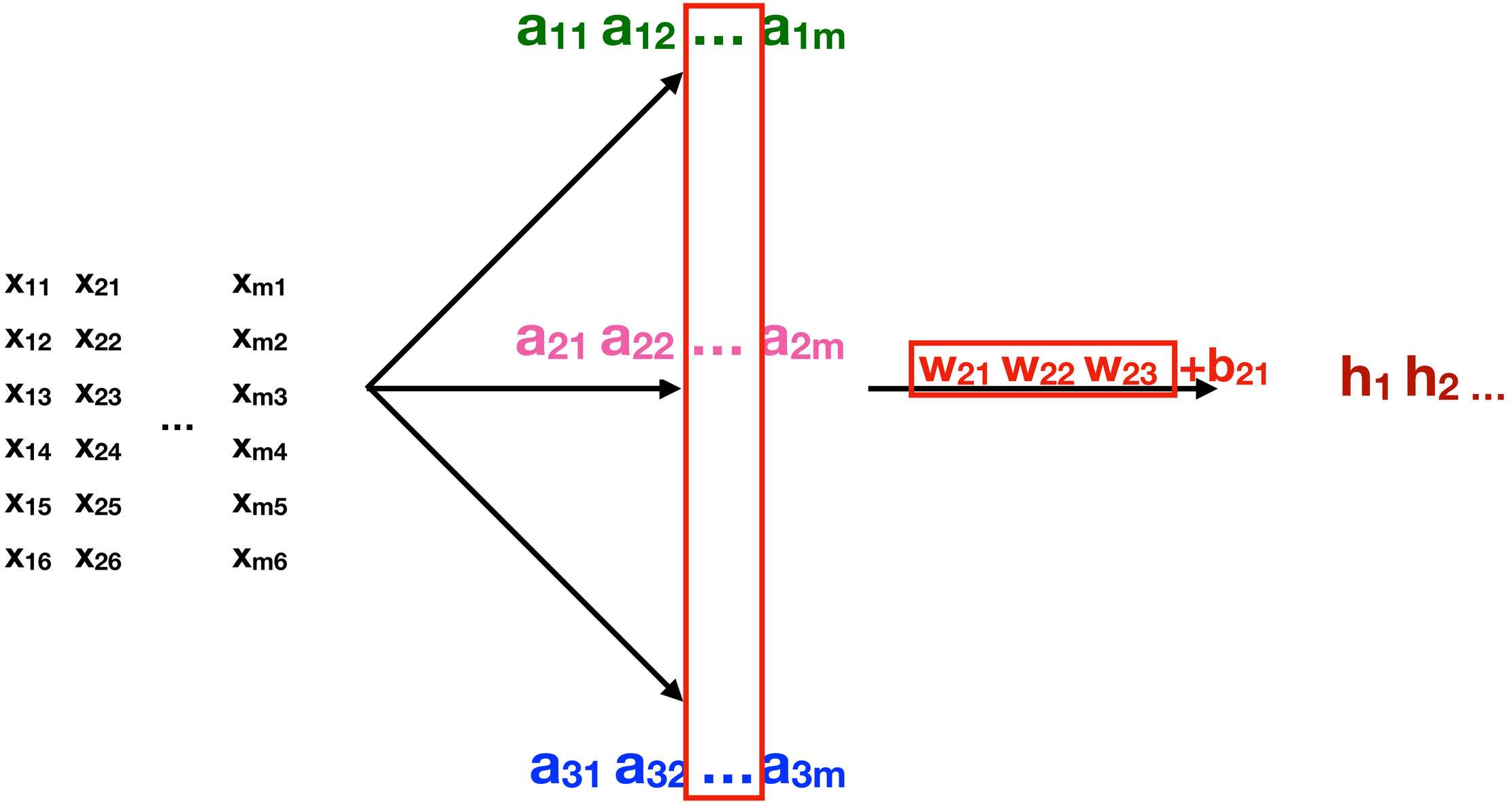

x_{11} x_{21} x_{m1}
x_{12} x_{22} x_{m2}
x_{13} x_{23} x_{m3}
...
x_{14} x_{24} x_{m4}
x_{15} x_{25} x_{m5}
x_{16} x_{26} x_{m6}
a_{11} a_{12} ... a_{1m}
a_{21} a_{22} ... a_{2m}
a_{31} a_{32} ... a_{3m}
w_{21} w_{22} w_{23} $+b_{21}$

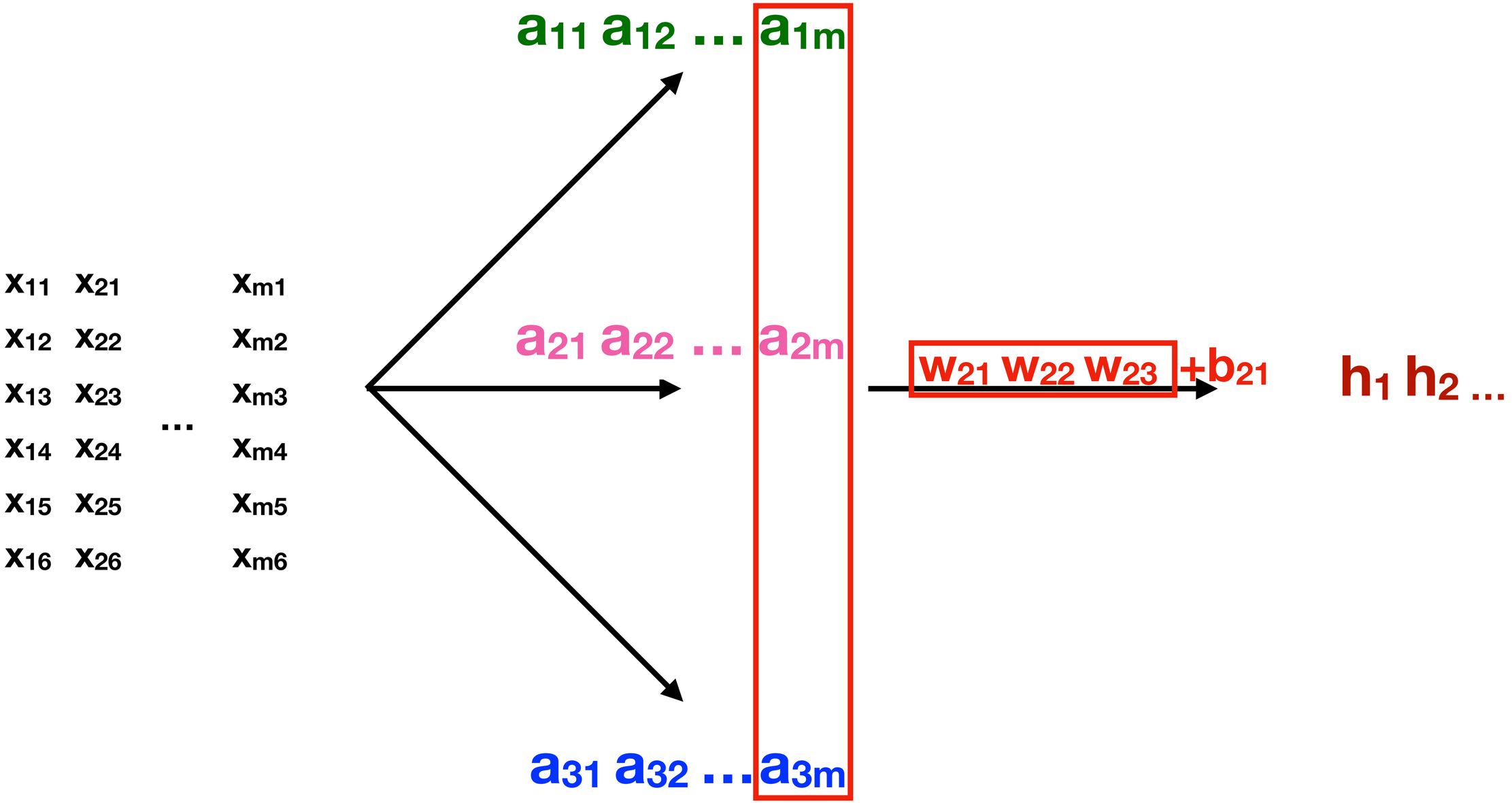

x_{11} x_{21} x_{m1}
x_{12} x_{22} x_{m2}
x_{13} x_{23} x_{m3}
...
x_{14} x_{24} x_{m4}
x_{15} x_{25} x_{m5}
x_{16} x_{26} x_{m6}
a_{11} a_{12} ... a_{1m}
a_{21} a_{22} ... a_{2m}
a_{31} a_{32} ... a_{3m}
w_{21} w_{22} w_{23} $+b_{21}$
h_1

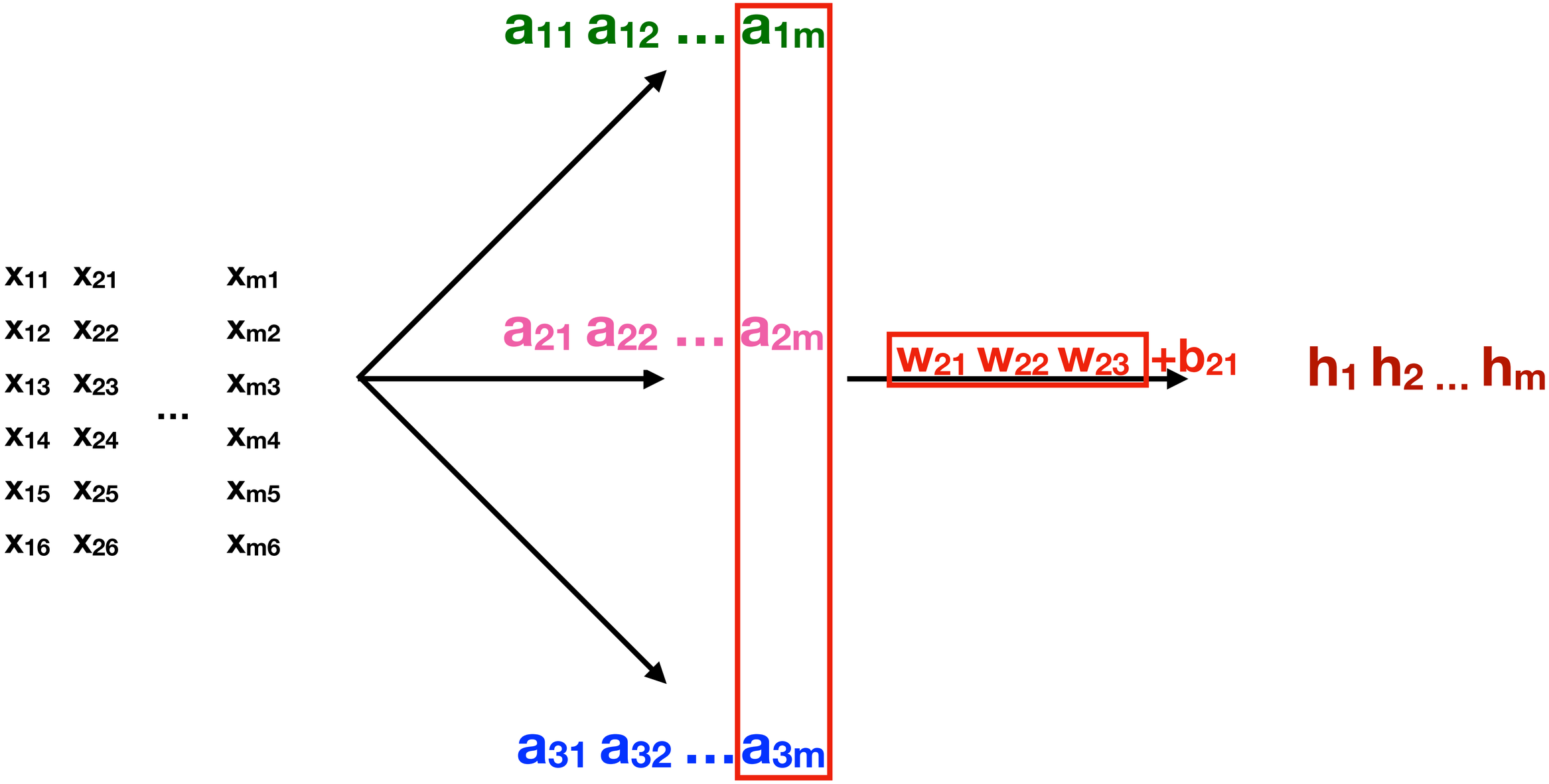

a11 a12 … a1m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
…
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
a21 a22 … a2m
W21 W22 W23 +b21
h1
a31 a32 …a3m

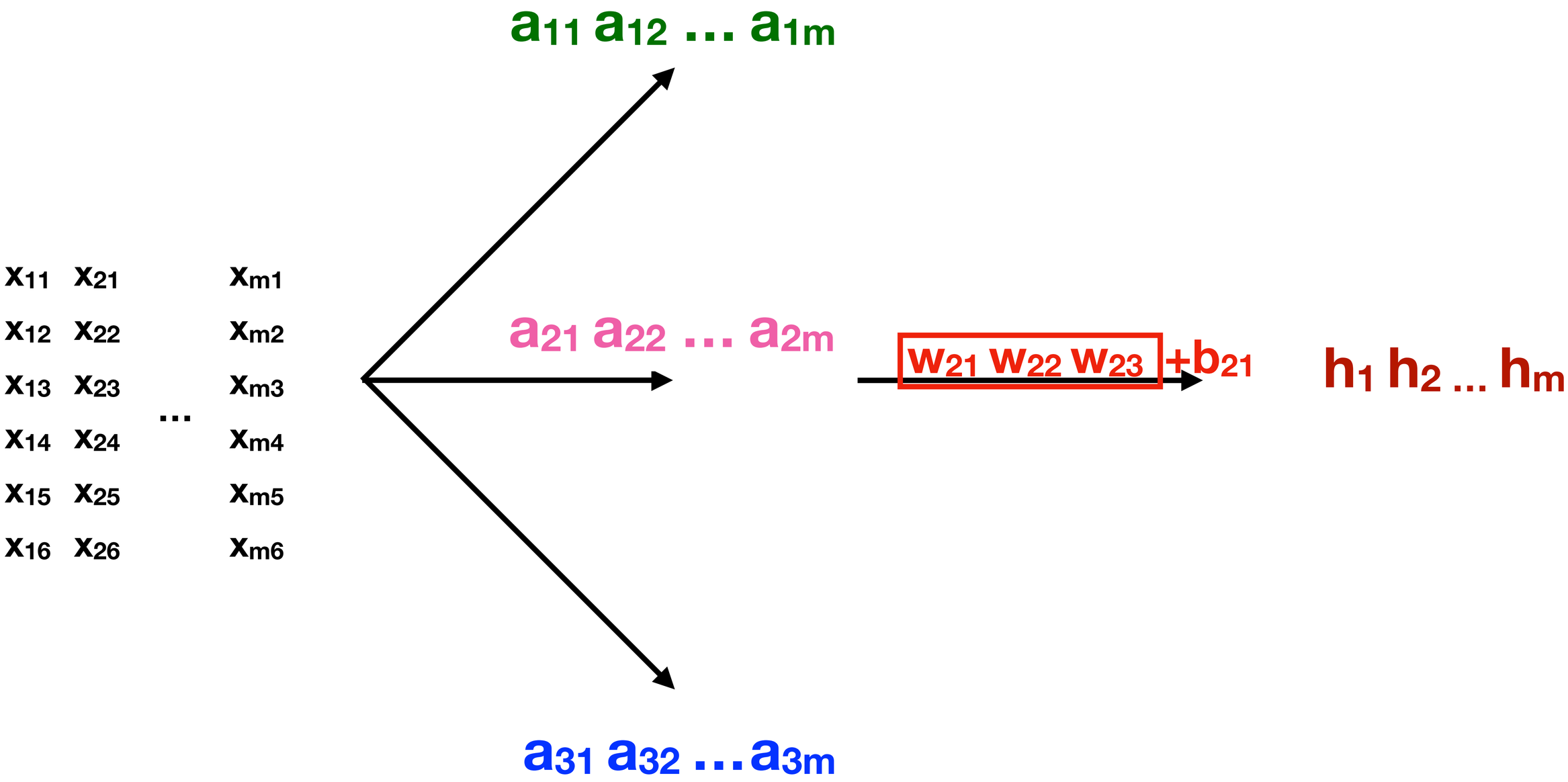

a11 a12 … a1m
a21 a22 … a2m
a31 a32 …a3m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
…
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w21 w22 w23 +b21
h1 h2


a11 a12 ... a1m
a21 a22 ... a2m
a31 a32 ... a3m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w21 w22 w23 +b21
h1 h2


a11 a12 ... a1m
a21 a22 ... a2m
a31 a32 ... a3m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w21 w22 w23 +b21
h1 h2 ...


a_{11} a_{12} … a_{1m}
a_{21} a_{22} … a_{2m}
a_{31} a_{32} … a_{3m}
x_{11} x_{21} x_{m1}
x_{12} x_{22} x_{m2}
x_{13} x_{23} x_{m3}
…
x_{14} x_{24} x_{m4}
x_{15} x_{25} x_{m5}
x_{16} x_{26} x_{m6}
w_{21} w_{22} w_{23} $+b_{21}$
h_1 h_2 …


a11 a12 … a1m
a21 a22 … a2m
a31 a32 … a3m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
…
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w21 w22 w23 +b21
h1 h2 … hm


a11 a12 ... a1m
a21 a22 ... a2m
a31 a32 ...a3m
x11 x21 xm1
x12 x22 xm2
x13 x23 xm3
...
x14 x24 xm4
x15 x25 xm5
x16 x26 xm6
w21 w22 w23 +b21
h1 h2 ... hm

2-Layer Neural Network