

The diagram illustrates the multiplication of a matrix  $\hat{\mathbf{X}}_{(n, p)}$  by a vector. The matrix is represented by a large gray rectangle. The result is shown as the sum of two products, each consisting of a scalar (in a red oval) multiplied by a column vector (in a blue rectangle). The first term is  $l_1 u_1$ , where  $l_1$  is the scalar and  $u_1$  is the column vector. The second term is  $l_2 u_2$ , where  $l_2$  is the scalar and  $u_2$  is the column vector. Above each column vector is an orange rectangle representing a row vector, labeled  $v_1$  and  $v_2$  respectively. The entire expression is set against a light gray background with a grid.

$$\hat{\mathbf{X}}_{(n, p)} = l_1 u_1 + l_2 u_2$$

where  $u_1$  and  $u_2$  are column vectors, and  $v_1$  and  $v_2$  are row vectors.