

Extracting action rules (action rules schemas) from incomplete tables using action reducts.

This method is extracting rules of 100% confidence.

After action rules schemas are extracted, we create rules headers (personalizing them).

Action Reducts

X	B	C	E	D
x1	b2	c1	e1	d2
x2	b1	c3	e2	d2
x3	b1	c1		d2
x4	b1	c3	e1	d2
x5	b1	c1	e1	d1
x6	b1	c1	e1	d1
x7	b2		e2	d1
x8	b1	c2	e2	d1

Discernable Table

$X_2 = \{x_1, x_2, x_3, x_4\}, X_1 = \{x_5, x_6, x_7, x_8\}$

	x1	x2	x3	x4
x5	b2	c3+e2	0	c3
x6	b2	c3+e2	0	c3
x7	c1+e1	b1+c3	b1+c1	b1+c3+e1
x8	b2+c1+e1	c3	c1	c3+e1

b2 is needed to discern x1 from x5

Action Reducts:

Action Rules:

$(B, \rightarrow b_2)(C, \rightarrow c_1) \Rightarrow (D, d_1 \rightarrow d_2)$

$(B, \rightarrow b_2)(E, \rightarrow e_1) \Rightarrow (D, d_1 \rightarrow d_2)$

$(C, \rightarrow c_3) \Rightarrow (D, d_1 \rightarrow d_2)$

$R(x_1) = b_2[c_1 + e_1][b_2 + c_1 + e_1] = b_2c_1 + b_2e_1$

$R(x_2) = c_3, R(x_3) = \text{NIL},$

$R(x_4) = c_3$

Example is on the next page.

Problem 1.

Assume that $\{A,B,C,D\}$ are flexible attributes and D is decision attribute. Follow the algorithm based on reducts to find action rules re-classifying objects from D_1 to D_2 in the table below.

X	A	B	C	D
x1	1	2	1	2
x2	2	1	2	2
x3	1	1	1	1
x4	2	2	2	1
x5	2	1	1	1

Solution:

	X1	X2
X3	B2	A2, C2
X4	A1, C1	B1
X5	A1, B2	C2

Reducts:

$$R(x1) = B2.(A1+C1).(A1+B2) = B2.(A1+C1) = B2.A1 + B2.C1$$

$$R(x2) = (A2+C2).B1.C2 = B1.C2$$

Rules:

$$(B, \rightarrow B2).(A, \rightarrow A1) \Rightarrow (D, D1 \rightarrow D2) \quad \text{Dom}=\{X3,X4,X5\}$$

$$(B, \rightarrow B2).(C, \rightarrow C1) \Rightarrow (D, D1 \rightarrow D2) \quad \text{Dom}=\{X3,X4,X5\}$$

$$(B, \rightarrow B1).(C, \rightarrow C2) \Rightarrow (D, D1 \rightarrow D2) \quad \text{Dom}=\{X3,X4,X5\}$$

$$\mathbf{C1.}(B, B1 \rightarrow B2).(A, \rightarrow A1) \Rightarrow (D, D1 \rightarrow D2) \quad \text{for C1, Dom}=\{X3,X5\}$$

$$\mathbf{C2.}(B, B2 \rightarrow B2).(A, A2 \rightarrow A1) \Rightarrow (D, D1 \rightarrow D2) \quad \text{for C2, Dom}=\{X4\}$$

$$A1.(B, B1 \rightarrow B2).(C, C1 \rightarrow C1) \Rightarrow (D, D1 \rightarrow D2) \quad \text{for A1, Dom}=\{X3\}$$

$$A2.(B, \rightarrow B2).(C, \rightarrow C1) \Rightarrow (D, D1 \rightarrow D2) \quad \text{for A2, Dom}=\{X4,X5\} \quad \text{No Change}$$

In a similar way, we extend the third rule

$$(B, \rightarrow B1).(C, \rightarrow C2) \Rightarrow (D, D1 \rightarrow D2) \quad \text{Dom}=\{X3,X4,X5\}$$