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Attribute Metadata for Relational OLAP and Data Mining

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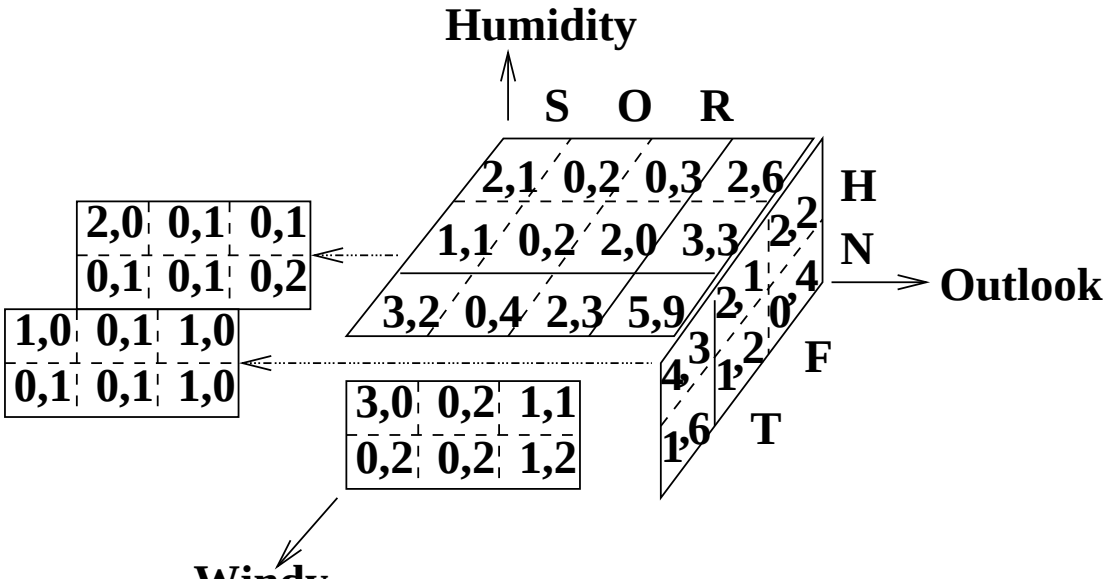
I Building a DataCube with the Domain Algebra



Trning	(*Ok*	*Tp*	*Hm*	*Wn*	*Cl*)
1	sn	ht	hi	f	N
2	sn	ht	hi	t	N
3	ov	ht	hi	f	P
4	rn	ml	hi	f	P
5	rn	cl	nm	f	P
6	rn	cl	nm	t	N
7	ov	cl	nm	t	P
8	sn	ml	hi	f	N
9	sn	cl	nm	f	P
10	rn	ml	nm	f	P
11	sn	ml	nm	t	P
12	ov	ml	hi	t	P
13	ov	ht	nm	f	P
14	rn	ml	hi	t	N

1. Count, Remove *Temperature* (*Tp*)

```
let N be equiv + of
  if Cl="N" then 1 else 0;                    N01
  by Ok, Hm, Wn;
let P be equiv + of
  if Cl="P" then 1 else 0;                    P01
  by Ok, Hm, Wn;
Trning <- [Ok, Hm, Wn, N, P] in Trning;
```

Trning	(*Ok*	*Hm*	*Wn*	N	P)
1,8	sn	hi	f	2	0
2	sn	hi	t	1	0
9	sn	nm	f	0	1
11	sn	nm	t	0	1
3	ov	hi	f	0	1
12	ov	hi	t	0	1
13	ov	nm	f	0	1
7	ov	nm	t	0	1
4	rn	hi	f	0	1
14	rn	hi	t	1	0
5,10	rn	nm	f	0	2
6	rn	nm	t	1	0

Intermediate Details:

let *N01* **be if** *Cl*="N" **then** 1 **else** 0;
let N **be equiv** + **of** *N01* **by** *Ok*, *Hm*, *Wn*;
let *P01* **be if** *Cl*="P" **then** 1 **else** 0;
let P **be equiv** + **of** *P01* **by** *Ok*, *Hm*, *Wn*;

Trning	(*Ok*	*Hm*	*Wn*	*Tp*	*Cl*)	*N01*	N	*P01*	P
1	sn	hi	f	ht	N	1	2	0	0
8	sn	hi	f	ml	N	1	2	0	0
2	sn	hi	t	ht	N	1	1	0	0
9	sn	nm	f	cl	P	0	0	1	1
11	sn	nm	t	ml	P	0	0	1	1
3	ov	hi	f	ht	P	0	0	1	1
12	ov	hi	t	ml	P	0	0	1	1
13	ov	nm	f	ht	P	0	0	1	1
7	ov	nm	t	cl	P	0	0	1	1
4	rn	hi	f	ml	P	0	0	1	1
14	rn	hi	t	ml	N	1	1	0	0
5	rn	nm	f	cl	P	0	0	1	2
10	rn	nm	f	ml	P	0	0	1	2
6	rn	nm	t	cl	N	1	1	0	0

2a. Sum Counts in *Windy* (*Wn*) Direction

let N **be** *totN*;
let P **be** *totP*;
let *Wn* **be** `"ANY"`;
let *totN* **be equiv** + **of** N **by** *Ok, Hm*;
let *totP* **be equiv** + **of** P **by** *Ok, Hm*;
update *Trning* **add**
[*Ok, Hm, Wn, N, P*] **in**
[*Ok, Hm, totN, totP*] **in** *Trning*;

The following are added to *Trning*

Trning	(*Ok*	*Hm*	*Wn*	N	P)
1,2,8	`sn`	`hi`	`ANY`	3	0
9,11	`sn`	`nm`	`ANY`	0	2
3,12	`ov`	`hi`	`ANY`	0	2
7,13	`ov`	`nm`	`ANY`	0	2
4,14	`rn`	`hi`	`ANY`	1	1
5,6,10	`rn`	`nm`	`ANY`	1	2

Intermediate Details:

let *totN* **be equiv** + **of** N **by** *Ok*, *Hm*;

let *totP* **be equiv** + **of** P **by** *Ok*, *Hm*;

Trning	(*Ok*	*Hm*	*Wn*	N	P)	*totN*	*totP*
1,8	sn	hi	f	2	0	3	0
2	sn	hi	t	1	0	3	0
9	sn	nm	f	0	1	0	2
11	sn	nm	t	0	1	0	2
3	ov	hi	f	0	1	0	2
12	ov	hi	t	0	1	0	2
13	ov	nm	f	0	1	0	2
7	ov	nm	t	0	1	0	2
4	rn	hi	f	0	1	1	1
14	rn	hi	t	1	0	1	1
5,10	rn	nm	f	0	2	1	2
6	rn	nm	t	1	0	1	2

let N **be** *totN*;

let P **be** *totP*;

let *Wn* **be** "ANY";

2b. Sum Counts in *Outlook* (*Ok*) Direction

let N **be** *totN*;
let P **be** *totP*;
let *Ok* **be** `"ANY"`; ←
let *totN* **be equiv** + **of** N **by** *Wn*, *Hm*; ←
let *totP* **be equiv** + **of** P **by** *Wn*, *Hm*; ←
update *Trning* **add**
[*Ok*, *Hm*, *Wn*, *N*, *P*] **in**
[*Wn*, *Hm*, *totN*, *totP*] **in** *Trning*; ←

The following are added to *Trning*

Trning	(*Ok*	*Hm*	*Wn*	N	P)
1,3,4,8	ANY	hi	f	2	2
2,12,14	ANY	hi	t	2	1
5,9.10,13	ANY	nm	f	0	4
6,7,11	ANY	nm	t	1	2
	ANY	hi	ANY	4	3
	ANY	nm	ANY	1	6

2c. Sum Counts in *Humidity* (*Hm*) Direction

let N **be** *totN*;
let P **be** *totP*;
let *Hm* **be** "ANY"; ←
let *totN* **be equiv** + **of** N **by** *Ok, Wn*; ←
let *totP* **be equiv** + **of** P **by** *Ok, Wn*; ←
update *Trning* **add**
[*Ok, Hm, Wn, N, P*] **in**
[*Ok, Wn, totN, totP*] **in** *Trning*; ←

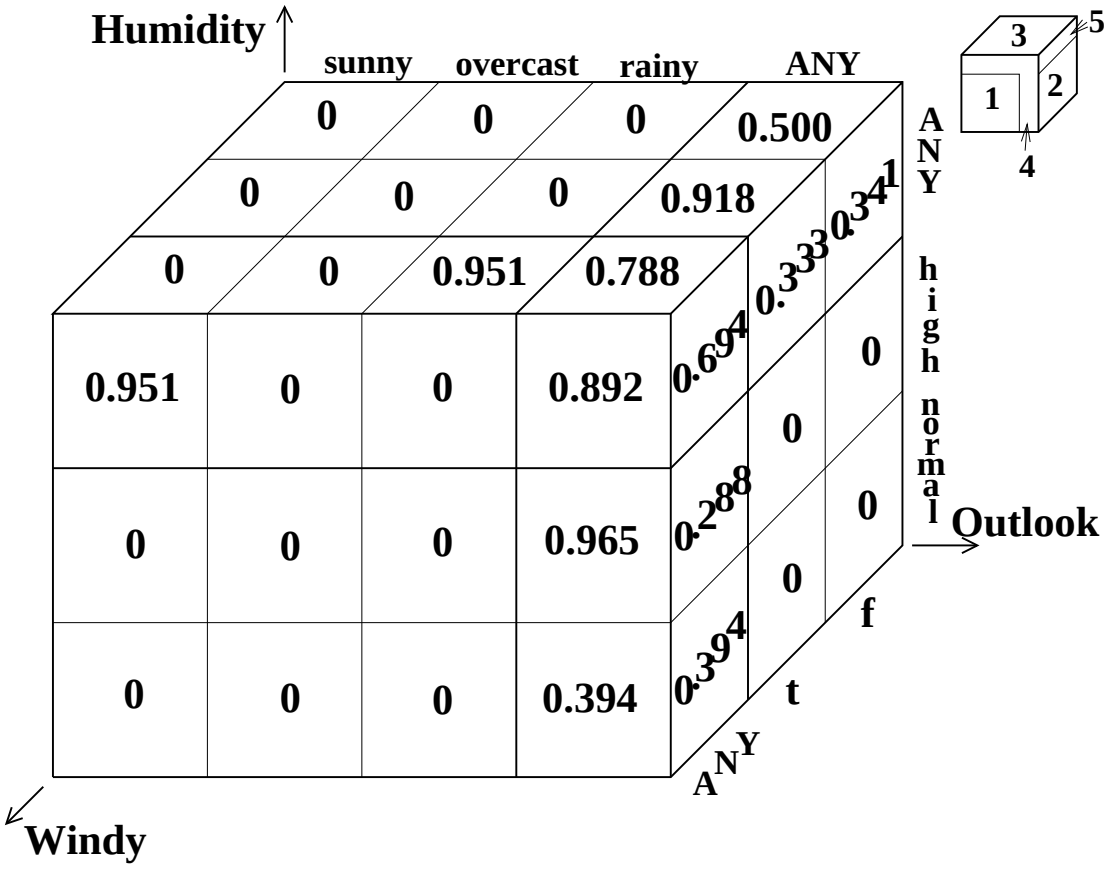
The following are added to *Trning*

Trning	(*Ok*	*Hm*	*Wn*	N	P)
1,8,9	sn	ANY	f	2	1
2,11	sn	ANY	t	1	1
	sn	ANY	ANY	3	2
3,13	ov	ANY	f	0	2
7,12	ov	ANY	t	0	2
	ov	ANY	ANY	0	4
4,14	rn	ANY	f	0	3
5,6,10	rn	ANY	t	2	0
	rn	ANY	ANY	2	3
	ANY	ANY	f	2	6
	ANY	ANY	t	3	3
	ANY	ANY	ANY	5	9

II 2a,b,c General Code, Using Attribute Metadata

```
    let N be totN;
    let P be totP;
    TotAttribs<-{totN, totP}                              ←
    PropAttribs<-{Wn, Ok, Hm}                             ←
    for Attribs in PropAttribs {
        let eval Attrib be "ANY";                         ←
        let totN be equiv + of N
        by (PropAttribs diff Attrib);                     ←
        let totP be equiv + of P
            by (PropAttribs diff Attrib);                 ←
        update Trning add [AllAttribs] in                 ←
            [PropAttribs diff Attrib                      ←
            union TotAttribs]                             ←
            in Trning;
    }
```

III Information DataCube for Decision Tree (loop $2d - 1 = 5$ times)



IV Nested Relations:
(New Syntax only to Add a Level)

ShoppingBasket

(*item*	*xact*)
`milk`	2
`bread`	1
`bread`	2
`bread`	3

let *xactset* **be relation**(*xact*);

(*item*	*xactset*) (*xact*)
`milk`	2
`bread`	1
`bread`	2
`bread`	3

let *xacts* **be equiv union of** *xactset* **by** *item*.

SBsets

(*item*	*xacts*) (*xact*)
`milk`	2
`bread`	1
	2
	3

let *count* **be** [**red** + **of** 1] **in** *xacts*;

SBsetsAgg

(*item*	*xacts* (*xact*)	*count*)
`milk`	2	1
`bread`	1	3
	2	
	3	

Intermediate Details: Raising by One Level

SBsets (*item*	*xacts*) (*xact*)	**red** + **of** 1	*count*
`milk`	2	1	1
`bread`	1	3	3
	2	3	
	3	3	

V The **transpose** Operator

Trning	(*Ok*	*Hm*	*Wn*	N	P)
	`sn`	`hi`	`f`	`2`	`0`
	`sn`	`hi`	`t`	`1`	`0`
	:	:	:	:	:

AllAttribs <– [**red ujoin of**
[*attr*] **transpose** *Ok*, *Hm*, *Wn*, *N*, *P*]
in *Trning*;

Trning	(*Ok*	*Hm*	*Wn*	N	P)	<**transpose**>	
						attr	*val*
	`sn`	`hi`	`f`	`2`	`0`	*Ok*	`sn`
						Hm	`hi`
						Wn	`f`
						N	`2`
						P	`0`
	`sn`	`hi`	`t`	`1`	`0`	*Ok*	`sn`
						Hm	`hi`
						Wn	`t`
						N	`1`
						P	`0`
	:	:	:	:	:	:	: