?
?
?
?
B
D
S
v
R_v
D_v
?
j
v
$c_{r_{(v,j)}}$

$$\mathcal{R}_v = \{r_{(v,i)} | 1 \leq i \leq R_v, i \in Z^+\}, \mathcal{C}_{\mathcal{R}_v} = \{c_{r_{(v,j)}} | 1 \leq j \leq R_v, j \in Z^+\}, \mathcal{D}_v = \{d_{(v,k)} | 1 \leq k \leq D_v, k \in Z^+\}, \quad (1)$$

$\mathcal{R}_v$
$\mathcal{C}_{\mathcal{R}_v}$
$\mathcal{D}_v$
v
$d_{(s,k)}$

$$R_{d_{(s,k)}} = B \log_2 (1 + \gamma_{d_{(s,k)}}), \quad (2)$$

B
$\gamma_{d_{(s,k)}}$
k
s

$$\gamma_{d_{(s,k)}} = \frac{p_{d_{(s,k)}} |h^H_{\mathcal{R}_s, d_{(s,k)}} w_{\mathcal{R}_s, d_{(s,k)}}|^2}{I_{d_{(s,k)}} + BN_0}. \quad (3)$$

$I_{d_{(s,k)}}$
BN_0
$h_{\mathcal{R}_s, d_{(s,k)}}$
k
s
$w_{\mathcal{R}_s, d_{(s,k)}}$
s
k
$p_{d_{(s,k)}}$
k
s
$y_{\mathcal{D}_s}$
$D_s \times$
1
s

$$y_{\mathcal{D}_s} = \sum_{v=1}^{S} H^H_{\mathcal{R}_v, \mathcal{D}_s} \hat{x}_{\mathcal{R}_v} + z_{\mathcal{D}_s}, \quad (4)$$

$\hat{x}_{\mathcal{R}_v} =$
$[\hat{x}_{r_{(v,1)}}, ..., \hat{x}_{r_{(v,\mathcal{R}_v)}}]^T \in$
C^{R_v}
v
$z_{\mathcal{D}_s} \mathcal{N}(0, N_0 I_{D_s})$
N_0
$H_{\mathcal{R}_v, \mathcal{D}_s} =$
$\left[h_{\mathcal{R}_v, d_{(s,1)}}, \ldots, h_{\mathcal{R}_v, d_{(s,\mathcal{D}_s)}}\right]^T \in$
$C^{R_v \times D_s}$
$\mathcal{R}_v$
$\mathcal{D}_s$
v
k
s
$h_{\mathcal{R}_v, d_{(s,k)}} \in$
C^{R_v}
?

$$h_{\mathcal{R}_v, d_{(s,k)}} = \beta^{\frac{1}{2}}_{\mathcal{R}_v, d_{(s,k)}} g_{\mathcal{R}_v, d_{(s,k)}}, \quad (5)$$

$g_{\mathcal{R}_v, d_{(s,k)}} \mathcal{N}(0, N_0 I_{\mathcal{D}_s})$
$\beta_{\mathcal{R}_v, d_{(s,k)}} =$
$diag(a_{r_{(v,1)}, d_{(s,k)}}, \ldots, a_{r_{(v,\mathcal{R}_v)}, d_{(s,k)}})$

$$\hat{x}_{\mathcal{R}_v} = \tilde{x}_{\mathcal{R}_v} + Q_{\mathcal{R}_v}, \quad (6)$$

$Q_{\mathcal{R}_v} =$
$\left[q_{r_{(v,1)}}, \ldots, q_{r_{(v,R_v)}}\right]^T$
$q_{M_{(t,i)}} \mathcal{N}(0, \sigma^2_{q_{(t,i)}})$

$$\tilde{x}_{\mathcal{R}_v} = \mathbf{W}_{\mathcal{R}_v, \mathcal{D}_v} \mathbf{P}^{\frac{1}{2}}_{\mathcal{D}_v} x_{\mathcal{D}_v},$$

$\hat{h}_{\mathcal{R}_v, d_{(s,k)}} =$
$h_{\mathcal{R}_v, d_{(s,k)}} +$
$\Delta h_{\mathcal{R}_v, d_{(s,k)}},$
$\Delta h_{\mathcal{R}_v, d_{(s,k)}}$
$\Delta h_{\mathcal{R}_v, d_{(s,k)}} \mathcal{N}(0, \phi^2_{\mathcal{R}_v, d_{(s,k)}}),$