

2024_0114_0148_12

1 Preliminaries

2 Useful Transformations

2.1 Difference-Based Binary-Hypothesis Selector

- Hypothesis
 - hypothesis:variable__side:range__space? binary | linearly_separable | neither |
- Conclusion
 - conclusion:direction? only_R_side | eq | neq | leq | geq | le | ge |
 - conclusion:L__side:variable?
 - conclusion:L__side:range?
 - conclusion:R__side:R₀__type? ignored | constant | variable |
 - conclusion:R__side:R₁__type? ignored | constant | variable |
 - conclusion:R__side:(R₀ – R₁)__type? any_ignored | constant | variable |

$$\begin{aligned}
 (L) \quad (\text{compare}) \quad & \begin{cases} R_0, & (\mathbf{a}^T \mathbf{x} + b) = 0 \\ R_1, & (\mathbf{a}^T \mathbf{x} + b) = 1 \end{cases} \\
 & \Updownarrow \\
 (L) \quad (\text{compare}) \quad & R_0 + (\mathbf{a}^T \mathbf{x} + b) \cdot (R_1 - R_0)
 \end{aligned} \tag{1}$$

2.2 Big-M-Based Binary-Hypothesis Selector

- Hypothesis
 - hypothesis:variable__side:range__space? binary | linearly_separable | neither |
- Conclusion
 - conclusion:direction? only_R_side | eq | neq | leq | geq | le | ge |
 - * geq: using \geq and $-|M|$ instead.
 - * eq: decomposing into one \leq and one \geq .
 - conclusion:L__side:variable?
 - conclusion:L__side:range?
 - conclusion:R__side:R₀__type? ignored | constant | variable |
 - conclusion:R__side:R₁__type? ignored | constant | variable |
 - conclusion:R__side:(R₀ – R₁)__type? any_ignored | constant | variable |

$$\begin{aligned}
L &\leq \begin{cases} R_0, & (\mathbf{a}^T \mathbf{x} + b) = 0 \\ R_1, & (\mathbf{a}^T \mathbf{x} + b) = 1 \end{cases} \\
&\quad \Downarrow \\
L &\leq \begin{cases} R_0, & (\mathbf{a}^T \mathbf{x} + b) = 0 \\ \text{ignored}, & (\mathbf{a}^T \mathbf{x} + b) = 1 \end{cases} \quad \wedge \quad L \leq \begin{cases} \text{ignored}, & (\mathbf{a}^T \mathbf{x} + b) = 0 \\ R_1, & (\mathbf{a}^T \mathbf{x} + b) = 1 \end{cases} \quad (2) \\
&\quad \Downarrow \\
L &\leq R_0 + ((\mathbf{a}^T \mathbf{x} + b) - 0) \cdot |M| \quad \wedge \quad L \leq R_1 + (1 - (\mathbf{a}^T \mathbf{x} + b)) \cdot |M|
\end{aligned}$$

2.3

(3)

(4)

(5)

(6)