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**Algorithm 1** BLS-Siamese net

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**Input:** Training data  $(I_{left}, I_{right}, I'_{left}, I'_{right})$ ,  $Y$ , feature extractor Siamese Net  
Conv1 and Conv2, number of feature mapping nodes  $N1$ , mapping window  
size  $N2$ , number of enhancement nodes  $N3$ .

**Output:** Weight of BLS  $W$ .

- 1:  $AI_{pet} = |Conv1(I_{left}) - Conv1(I_{right})|$
  - 2:  $AI_{mri} = |Conv2(I'_{left}) - Conv2(I'_{right})|$
  - 3:  $AI_{pr} = |Conv1(I^{left} - Conv2(I'_{right})|$
  - 4:  $AI_{rp} = |Conv1(I^{left'} - Conv1(I_{right})|$
  - 5:  $X = [AI_{pet}, AI_{mri}, AI_{pr}, AI_{rp}]$
  - 6: **for**  $I=1,2, \dots, N1$  **do**
  - 7:   Random generate weight and bias  $W_{f_i}, \beta_{f_i}$  with size  $N2$
  - 8:   calculate  $Z_i = \phi_i(XW_{f_i} + \beta_{f_i})$
  - 9: **end for**
  - 10: set feature mapping group  $Z \equiv [Z_1, Z_2, \dots, Z_{N1}]$
  - 11: **for**  $j=1,2, \dots, N3$  **do**
  - 12:   Random generate weight and bias  $W_{e_j}, \beta_{e_j}$
  - 13:   Calculate  $H_j = \xi_j(ZW_{e_j} + \beta_{e_j})$
  - 14: **end for**
  - 15: set  $H \equiv [H_1, H_2, \dots, H_{N3}]$
  - 16:  $A = [Z|H]$
  - 17: compute hidden weight  $W$  by ridge regression
  - 18: Returns
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