Symbol	DESCRIPTION
A_S	sender agent
A_R	receiver agent
S	set of all possible messages used for communication by both agents
O	set of mammal classes
O_S	set of mammal images available to the sender
O_R	set of mammal descriptions available to the receiver
s^*	ground-truth map between O_S and O_R, namely $s^*: O_S \times O_R \to \{0, 1\}$
o_s	element of O_S
o_r	element of O_R
o_r^*	element of O_R corresponding to the correct object in a sender-receiver exchange
o_r^t	the receiver's predicted distribution over objects in O_R at timestep t
$\hat{o}_r$	the receiver's prediction
m_s	binary message sent by the sender
m_r	binary message sent by the receiver
Ξ	set of binary indicators for terminating a conversation $\{0, 1\}$
s	value of indicator for terminating conversation yielded by the receiver
s^t	value of indicator for terminating conversation yielded by the receiver at time step t
T_{max}	maximal value for number of time steps in a conversation
t	time step in conversation between sender and receiver
m_s^t	binary message generated by sender at time step t
m_r^t	binary message generated by receiver at time step t
h_s	hidden state vector of the sender
h_r	hidden state vector of the receiver
h_r^t	hidden state of receiver at time step t
$f_s(o_s, m_r)$	function computing hidden state h_s of sender
$f_{s,att}(o_s, m_r)$	function computing hidden state h_s of attention-based sender
$f_r(m_s, h_r^{t-1})$	the receiver's recurrent activation function computing h_r^t
B_s	baseline feedforward network of the sender
B_s	baseline feedforward network of the receiver
$m_{s,j}$	the j-th coordinate of the sender's message
$w_{s,j}$	the j-th column of the sender's weight matrix
$b_{s,j}$	the j-th coordinate of the sender's bias vector
$g_r(o_r)$	embedding of an object o by the receiver's view o_r
$m_{r,j}^t$	the j-th coordinate of the receiver's message
W_r	the receiver's weight matrix for its hidden space
U_r	the receiver's weight matrix for embeddings of $o_r \in O_R$
c_r	the receiver's bias vector for embeddings of $o_r \in O_R$
$w_{r,j}$	the j-th column of the receiver's weight matrix W_r
$b_{r,j}$	the j-th coordinate of the receiver's bias vector for hidden state
$v^\top$	the transpose of vector v
L^i	per-instance loss
L_R^i	per-instance reinforcement learning loss
L_B^i	per-instance baseline loss
R	reward from ground-truth mapping s^*
H	entropy
λ_m	entropy regularization coefficient for the binary messages distributions of both agents
λ_s	entropy regularization coefficient for the receiver's termination distribution