	Q-learning	Deep Q-learning
Vehicle:		
• Type HEV	• Parallel P2 PHEV	• Parallel P2 PHEV
• Vehicle class	• Luxury class vehicle	• Luxury class vehicle
• Vehicle weight in kg	• 1815	• 1815
• Gearbox	• 9-gear automatic transmission	• 9-gear automatic transmission
• A_f in m^2	• 2.16	• 2.16
• c_d	• 0.26	• 0.26
• k_R, linear function	• $\frac{1}{3000} \cdot v_{vehicle} + 0.98$	• $\frac{1}{3000} \cdot v_{vehicle} + 0.98$
• $f_{Roll,i}$	• 0.009	• 0.009
• r_{dyn} in m	• 0.32	• 0.32
• i_D	• 4.18	• 4.18
• η_G in %	• 0.91	• 0.91
• $s_{\text{slip factor}}$	• 1.05	• 1.05
ICE:		
• Type	• Gasoline DI, homogeneous	• Gasoline DI, homogeneous
• Charging system	• Roots-type supercharged	• Twin-Scroll turbocharged
• Cylinder	• V6	• six in line
• Compression ratio	• 10.5:1	• 10.2:1
• Displacement in l	• 3.0	• 3.0
• Maximum power in kW	• 213, at 4850-7000 rpm	• 225, at 5800 rpm
• Maximum torque in kW	• 420, at 2500-4850 rpm	• 400, at 1200-5000 rpm
• Emission certification	• Euro 5	• Euro 5
EM:		
• Type	• PMSM	• PMSM
• Nominal speed in rpm	• 4000	• 4000
• Maximum speed in rpm	• 12000	• 12000
• Nominal power in kW	• 35	• 35
• Maximum power in kW	• 50	• 50
• Maximum torque in Nm	• 120	• 120
• Nominal current in A	• 160	• 160
• Maximum current in A	• 250	• 250
• Number of pole pair	• 4	• 4
• Nominal voltage in V	• 110	• 110
• DC-Voltage in V	• 250-405	• 250-405
Battery:		
• Gross energy throughput in kWh	• 15	• 15
• Net energy throughput in kWh	• 13.5	• 13.5
• DoD at gross energy throughput	• 90-30 %	• 90-30 %
• Capacity Q battery cell in Ah		• 4.8
• Capacity Q battery stack in Ah		• 87
• Nominal voltage battery stack in V		• 155
• Nominal voltage battery cell in V		• 3.6
• Charging end voltage battery stack in V		• 180
• Charging end voltage battery cell in V		• 4.2
• Discharging end voltage battery stack in V		• 107
• Discharging end voltage battery cell in V		• 2.5
• Number of cells		• 781.25
• C-rate		• 3

Symbol	Meaning	Unit
x_n	Input of neural network	
w_{ji}	Weight of neuron, unit	
w_{j0}	Bias of neuron, unit	
$\mathbf{w}_t$	Weight vector of neural network	
a_j	Activation of neuron, unit	
z_j	Output of neuron, unit	
$f(a_j)$	Activation function of neuron, unit	
y_k	Total output of neural network	
$E(w)$	Error function	
t_n	Target variable	
δ	Gradient of error function	
τ	Iteration step	
α	Learning rate, step size	
β	Momentum hyperparameter	
A_t, a	Actual action	
S_t, s	Actual state	
R_t, r	Actual reward	
A_{t+1}	Next action	
S_{t+1}, s’	Next state	
R_{t+1}	Next reward	
p	Probability distribution	
G_t	Return, reward sequence	
γ	Discount rate	
$\pi(s)$	Deterministic policy	
$\pi(a\|s)$	Stochastic policy	
$v_\pi(s)$	State-value function	
E_π	Expected value	
$q_\pi(s,a)$	Action-value function	
$v_*(s)$	Optimal state-value function	
$q_*(s,a)$	Optimal action-value function	
ϵ	Exploration factor	
$Q(S_t, A_t)$	Actual Q-value	
δ_t	TD-error	
$\max_a Q(S_{t+1}, a)$	Maximum next Q-value	
e_t	Experience replay	
$\widehat{Q}$	Q-value of target Q-network	
$\max_a \widehat{Q}(S_{t+1}, a, \mathbf{w}_t)$	Maximum next Q-value target Q-network	
F_D	Total driving force	N
k_R	Correction factor tire expansion	
r_{dyn}	Dynamic rolling radius	m
η	Efficiency	%
i	Gear ratio	
M	Torque	Nm
$v_{vehicle}$, v	Vehicle velocity or velocity in general	km/h
v_{rel}	Inflow velocity of the vehicle	km/h
F_{Roll}	Rolling resistance	N
$f_{Roll,i}$	Rolling resistance coefficient	
$F_{WheelLoad,i}$	Wheel load per wheel	N
F_{Air}	Air resistance	N
c_d	Drag coefficient	

ρ	Density	kg/m^3
A_f	Cross sectional area	m^2
F_{Acc}	Acceleration resistance	N
$m_{vehicle}$	Vehicle mass	kg
$a_{vehicle}$	Vehicle acceleration	m/s^2
n	Speed at gearbox input shaft	rpm
$s_{slip\ factor}$	Slip factor	
Δv	Relative velocity	km/h
Δt	Time difference	s
W	Battery energy	kWh
P	Power	W
t	Time step	s
U	Voltage	V
Q_{batt}	Capacity battery	Ah
I	Current	A
C	C-rate	$1/h$
Δ_ϵ	Exploration factor decay	
Δ_γ	Discount rate decay	
Δ_α	Learning rate, step size decay	
Δ_{error}	Relative test error	$\%$