gamblers_problem

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[ ]:
```python
#!/usr/bin/env python

"""
Entrega #4 - Dynamic Programming - Value iteration Gambler's Problem

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"""

import numpy as np
import matplotlib.pyplot as plt

print(__doc__)

class Gambler:
    """
    Class Gambler.
    Have all methods needed to implement the Gambler's problem
    with value iteration.
    """

    def __init__(self, prob, iterations, theta=0.00000001):
        self.value = np.zeros(101) # Set a list of 100 values 0
        self.reward = np.zeros(101) # Set a list of 100 values 0
        self.reward[100] = 1 # Set 1 on the last element
        self.values_recorded = []
        self.pi = []
        self.prob = prob
        self.iterations = iterations
        self.theta = theta

    def value_iteration(self):
        """
        Value iteration, for estimating policy.
        Theta will determine accuracy of estimation
        """
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        delta = 0
        p = np.zeros(101)
        while delta < self.theta:
            for capital in range(1,100):
                # Store the previous value of current state
                previous_value = self.value[capital]
                # Bet value with minimum of 1 and maximum of 100 - capital
                for bet in range(1, min(capital, 100 - capital)+1):
                    # Calculates the value of a bet(action) from a current␣
↪amount of money(state)
                    p[bet] = self.prob*(self.reward[capital + bet] + self.
↪value[capital + bet]) + (1-self.prob)*(self.reward[capital - bet] + self.
↪value[capital - bet])
                # Update the maximum value
                self.value[capital] = max(p)
                # Update delta
                delta = max(delta, abs(previous_value - self.value[capital]))
        # Store the new values
        self.values_recorded.append(self.value.copy())

    def policy(self):
        """
        Output the optimal policy
        """
        self.pi = []
        p = np.zeros(101)
        for capital in range(1,100):
            # Bet value with minimum of 1 and maximum of 100 - capital
            for bet in range(1, min(capital, 100 - capital)+1):
                # Calculates the value of a bet(action) from a current amount␣
↪of money(state)
                p[bet] = self.prob*(self.reward[capital + bet] + self.
↪value[capital + bet]) + (1-self.prob)*(self.reward[capital - bet] + self.
↪value[capital - bet])
            # Store the new optimal policy
            self.pi.append(np.argmax(p))

    def compute(self):
        """
        Compute the successive iterations and the final policy
        """
        for i in range(self.iterations):
            self.value_iteration()
            self.policy()
        self.plot_results()

    def plot_results(self):
```

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        """
        Plot on a graph the value function by successive iterations and the␣
↪final policy
        """
        plt.subplot(2, 1, 1)
        for data in self.values_recorded:
            plt.plot(data[:99])
        labels = ['Iteration {}'.format(i+1) for i in range(len(self.
↪values_recorded))]
        plt.legend(labels)
        plt.xlabel('Capital')
        plt.ylabel('Value Estimates')
        plt.subplot(2, 1, 2)
        plt.bar(range(99), self.pi, align='center', alpha=0.5)
        plt.xlabel('Capital')
        plt.ylabel('Final Policy')
        plt.show()


if __name__ == "__main__":
    g = Gambler(0.4, 5)
    g.compute()
```

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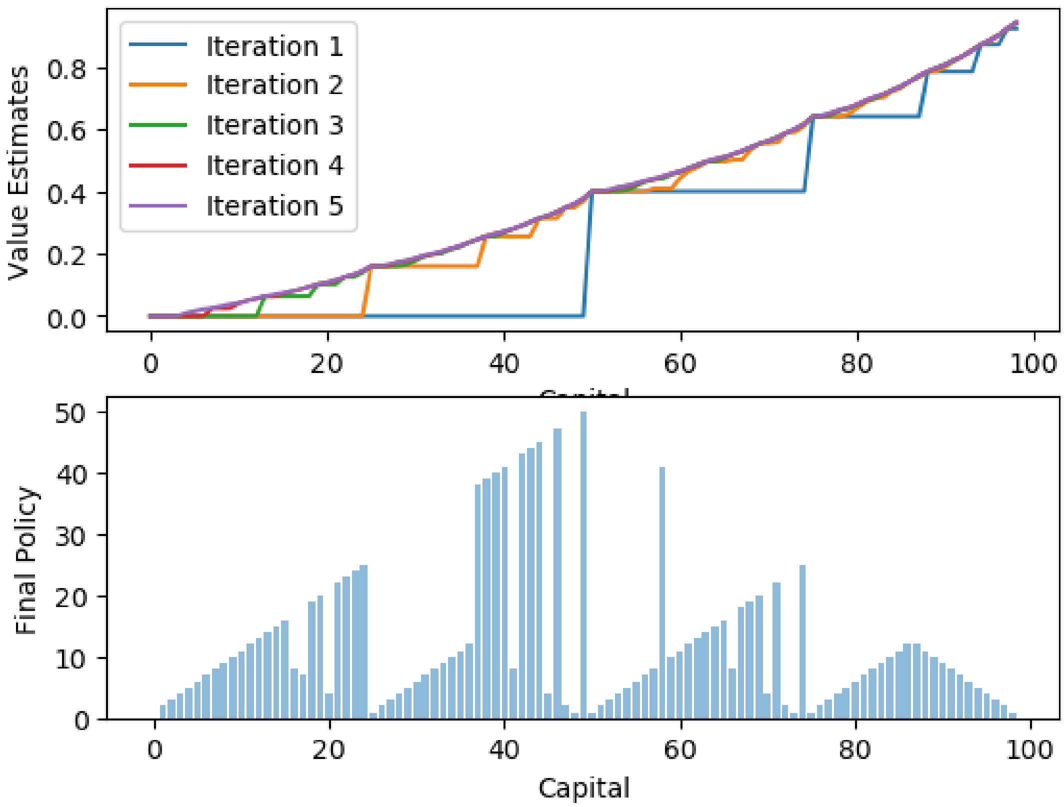
Iteration 1
Iteration 2
Iteration 3
Iteration 4
Iteration 5
Value Estimates
0.0
0.2
0.4
0.6
0.8
0
20
40
60
80
100
Final Policy
0
10
20
30
40
50
Capital