FOUNDATIONS OF MACHINE LEARNING
HOMEWORK 3 REPORT

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Approach:

- **'fit' function:** Computed different probability distribution parameters and prior probabilities based on formulas found on the internet.
- **'getParams' function:** Returns the prior and different parameter values calculated in fit function.
- **'predict' function:** Calculated different **log probabilities** of a label for all distribution functions and then added them. Did this for every label and stored in a prediction variable. Next used argmax function for predicting the label and get the final predictions.
- **'precision' function:** Implemented based on the formula *TP/(TP+FP).*
- **'recall' function:** Implemented based on the formula *TP/(TP+FN).*
- **'f1score'** function: Implemented based on the formula *2*p*r/(p+r)*.

Different Parameter Values:

- **Priors:** {0: 0.3333333333333333, 1: 0.3333333333333333, 2: 0.3333333333333333}
- **Gaussian:** {0: [2.020949221262834, 3.906773391001713, 9.051951599740695, 78.42834902344524], 1: [0.02138694302298476, 0.8559179206674215, 25.160891156967665, 230.0318574244357], 2: [8.024850386913617, -0.02166141391840839, 35.66886557103011, 4.007543732602722]}
- **Bernoulli:** {0: [0.2023, 0.104], 1: [0.5984, 0.8018], 2: [0.9053, 0.1947]}
- **Laplace:** {0: [0.07663290080139726, 0.8728088194522259, 1.9835868353591206, 5.97817981471889], 1: [0.3828421949589657, 0.3513042893496608, 0.9993885462832554, 5.998375268616778], 2: [0.7963798633331391, 0.21251669112109534, 3.005028976890498, 3.061486767564628]}
- **Exponential:** {0: [1.9782998189239358, 3.9354247815333876], 1: [2.984109539791241, 7.980035445543935], 2: [8.942725229219866, 14.684989790967823]}
- **Multinomial:** {0: [array([0.2022, 0.2032, 0.2042, 0.1967, 0.1937]), array([0.1213, 0.1236, 0.1257, 0.1277, 0.127 , 0.1271, 0.1241, 0.1235])], 1: [array([0.0977, 0.1984, 0.4047, 0.1583, 0.1409]), array([0.1009, 0.0506, 0.0508, 0.1998, 0.1524, 0.1487, 0.2003, 0.0965])], 2: [array([0.2052, 0.2997, 0.1029, 0.3417, 0.0505]), array([0.1972, 0.0481, 0.0483, 0.1054, 0.1552, 0.153 , 0.098 , 0.1948])]}

Accuracies and F1-Scores:

- **Training Accuracy:** 0.9013666666666666
- **Validation Accuracy:** 0.9023333333333333
- **Training F1 Score:** [0.881123775244951, 0.8787372894217635, 0.9434969598101735]
- **Validation F1 Score:** [0.8809796405993329, 0.8784676354029063, 0.9467596025507935]