In [1]:
```
#SVM CLASSIFIER

import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

In [2]:
```
df=pd.read_csv("DATA/mouse_viral_study.csv")
df.head()
```

Out[2]:

	Med_1_mL	Med_2_mL	Virus Present
0	6.508231	8.582531	0
1	4.126116	3.073459	1
2	6.427870	6.369758	0
3	3.672953	4.905215	1
4	1.580321	2.440562	1

In [3]:
```
df.describe()
```

Out[3]:

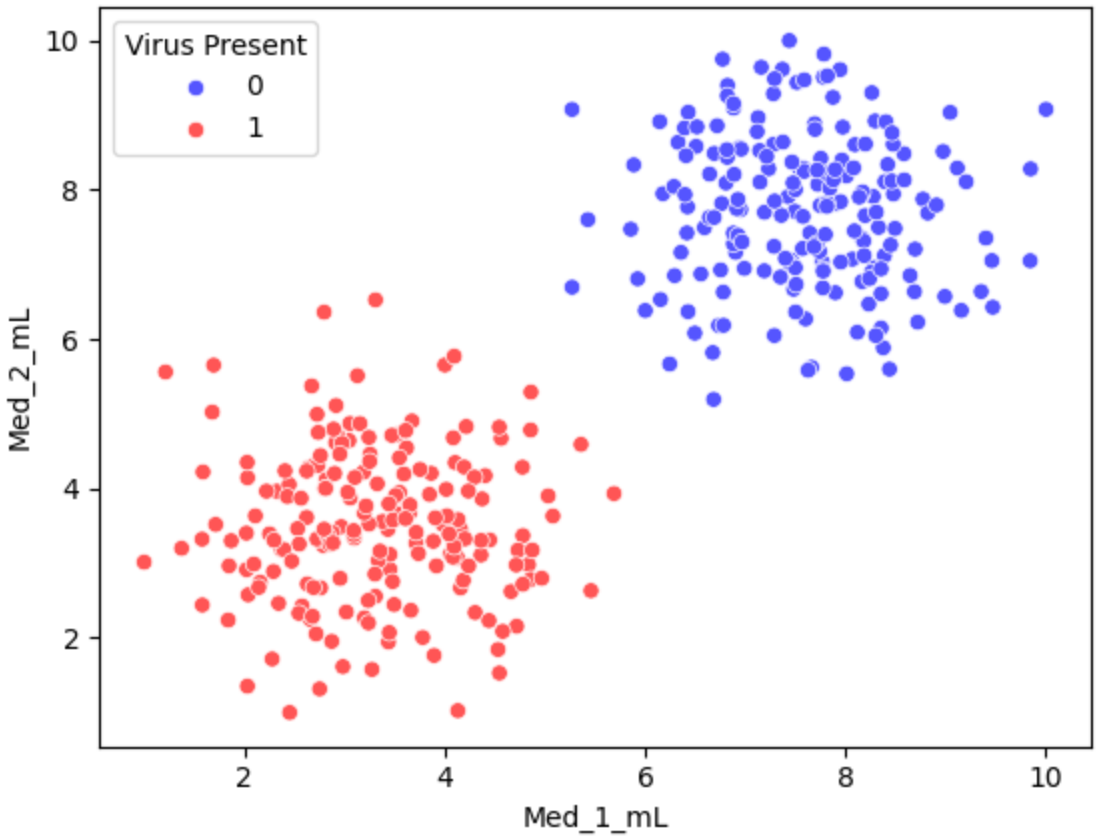
	Med_1_mL	Med_2_mL	Virus Present
count	400.000000	400.000000	400.000000
mean	5.447984	5.616750	0.500000
std	2.319059	2.336637	0.500626
min	1.000000	1.000000	0.000000
25%	3.249062	3.431311	0.000000
50%	5.393776	5.638471	0.500000
75%	7.630389	7.782614	1.000000
max	10.000000	10.000000	1.000000

In [4]:
```
df.columns
```

Out[4]:
```
Index(['Med_1_mL', 'Med_2_mL', 'Virus Present'], dtype='object')
```

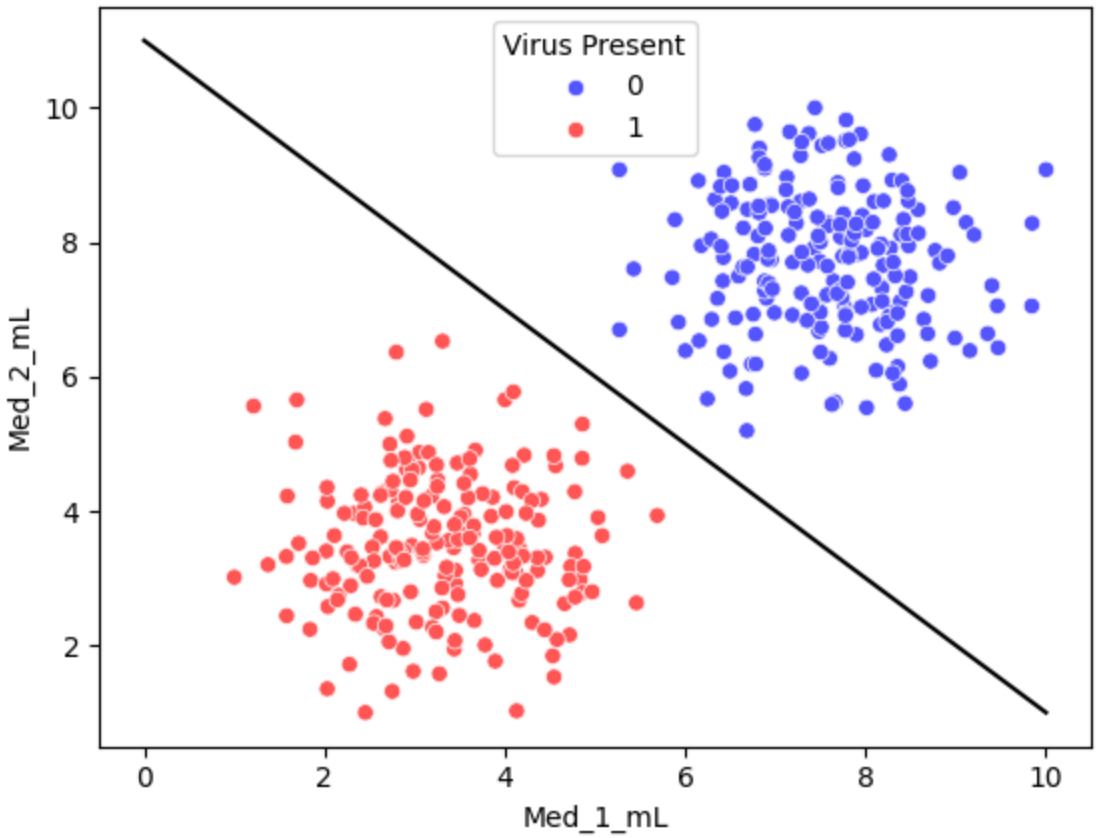
In [5]:
```
sns.scatterplot(x='Med_1_mL', y='Med_2_mL', hue='Virus Present', data=df,palette='s
```

Out[5]:
```
<Axes: xlabel='Med_1_mL', ylabel='Med_2_mL'>
```



In [8]:
```
sns.scatterplot(x='Med_1_mL', y='Med_2_mL', hue='Virus Present', data=df,palette='s
x=np.linspace(0,10,100)
m=-1
b=11
y=m*x+b
plt.plot(x,y,'k')
```

Out[8]:
```
[<matplotlib.lines.Line2D at 0x1c3d341f650>]
```



In [9]:
```
from sklearn.svm import SVC
```

In [10]:
```
help(SVC)
```

```
Help on class SVC in module sklearn.svm._classes:

class SVC(sklearn.svm._base.BaseSVC)
 |  SVC(*, C=1.0, kernel='rbf', degree=3, gamma='scale', coef0=0.0, shrinking=True,
probability=False, tol=0.001, cache_size=200, class_weight=None, verbose=False, max_
iter=-1, decision_function_shape='ovr', break_ties=False, random_state=None)
 |
 |  C-Support Vector Classification.
 |
 |  The implementation is based on libsvm. The fit time scales at least
 |  quadratically with the number of samples and may be impractical
 |  beyond tens of thousands of samples. For large datasets
 |  consider using :class:`~sklearn.svm.LinearSVC` or
 |  :class:`~sklearn.linear_model.SGDClassifier` instead, possibly after a
 |  :class:`~sklearn.kernel_approximation.Nystroem` transformer or
 |  other :ref:`kernel_approximation`.
 |
 |  The multiclass support is handled according to a one-vs-one scheme.
 |
 |  For details on the precise mathematical formulation of the provided
 |  kernel functions and how `gamma`, `coef0` and `degree` affect each
 |  other, see the corresponding section in the narrative documentation:
 |  :ref:`svm_kernels`.
 |
 |  To learn how to tune SVC's hyperparameters, see the following example:
 |  :ref:`sphx_glr_auto_examples_model_selection_plot_nested_cross_validation_iris.p
y`
 |
 |  Read more in the :ref:`User Guide <svm_classification>`.
 |
 |  Parameters
 |  ----------
 |  C : float, default=1.0
 |      Regularization parameter. The strength of the regularization is
 |      inversely proportional to C. Must be strictly positive. The penalty
 |      is a squared l2 penalty. For an intuitive visualization of the effects
 |      of scaling the regularization parameter C, see
 |      :ref:`sphx_glr_auto_examples_svm_plot_svm_scale_c.py`.
 |
 |  kernel : {'linear', 'poly', 'rbf', 'sigmoid', 'precomputed'} or callable,
default='rbf'
 |      Specifies the kernel type to be used in the algorithm. If
 |      none is given, 'rbf' will be used. If a callable is given it is used to
 |      pre-compute the kernel matrix from data matrices; that matrix should be
 |      an array of shape ``(n_samples, n_samples)``. For an intuitive
 |      visualization of different kernel types see
 |      :ref:`sphx_glr_auto_examples_svm_plot_svm_kernels.py`.
 |
 |  degree : int, default=3
 |      Degree of the polynomial kernel function ('poly').
 |      Must be non-negative. Ignored by all other kernels.
 |
 |  gamma : {'scale', 'auto'} or float, default='scale'
 |      Kernel coefficient for 'rbf', 'poly' and 'sigmoid'.
 |
 |      - if ``gamma='scale'`` (default) is passed then it uses
```

```
|       1 / (n_features * X.var()) as value of gamma,
|     - if 'auto', uses 1 / n_features
|     - if float, must be non-negative.
|
|     .. versionchanged:: 0.22
|        The default value of ``gamma`` changed from 'auto' to 'scale'.
|
|  coef0 : float, default=0.0
|      Independent term in kernel function.
|      It is only significant in 'poly' and 'sigmoid'.
|
|  shrinking : bool, default=True
|      Whether to use the shrinking heuristic.
|      See the :ref:`User Guide <shrinking_svm>`.
|
|  probability : bool, default=False
|      Whether to enable probability estimates. This must be enabled prior
|      to calling `fit`, will slow down that method as it internally uses
|      5-fold cross-validation, and `predict_proba` may be inconsistent with
|      `predict`. Read more in the :ref:`User Guide <scores_probabilities>`.
|
|  tol : float, default=1e-3
|      Tolerance for stopping criterion.
|
|  cache_size : float, default=200
|      Specify the size of the kernel cache (in MB).
|
|  class_weight : dict or 'balanced', default=None
|      Set the parameter C of class i to class_weight[i]*C for
|      SVC. If not given, all classes are supposed to have
|      weight one.
|      The "balanced" mode uses the values of y to automatically adjust
|      weights inversely proportional to class frequencies in the input data
|      as ``n_samples / (n_classes * np.bincount(y))``.
|
|  verbose : bool, default=False
|      Enable verbose output. Note that this setting takes advantage of a
|      per-process runtime setting in libsvm that, if enabled, may not work
|      properly in a multithreaded context.
|
|  max_iter : int, default=-1
|      Hard limit on iterations within solver, or -1 for no limit.
|
|  decision_function_shape : {'ovo', 'ovr'}, default='ovr'
|      Whether to return a one-vs-rest ('ovr') decision function of shape
|      (n_samples, n_classes) as all other classifiers, or the original
|      one-vs-one ('ovo') decision function of libsvm which has shape
|      (n_samples, n_classes * (n_classes - 1) / 2). However, note that
|      internally, one-vs-one ('ovo') is always used as a multi-class strategy
|      to train models; an ovr matrix is only constructed from the ovo matrix.
|      The parameter is ignored for binary classification.
|
|      .. versionchanged:: 0.19
|          decision_function_shape is 'ovr' by default.
|
|      .. versionadded:: 0.17
```

```
|        *decision_function_shape='ovr'* is recommended.
|
|      .. versionchanged:: 0.17
|         Deprecated *decision_function_shape='ovo' and None*.
|
|  break_ties : bool, default=False
|      If true, ``decision_function_shape='ovr'``, and number of classes > 2,
|      :term:`predict` will break ties according to the confidence values of
|      :term:`decision_function`; otherwise the first class among the tied
|      classes is returned. Please note that breaking ties comes at a
|      relatively high computational cost compared to a simple predict.
|
|      .. versionadded:: 0.22
|
|  random_state : int, RandomState instance or None, default=None
|      Controls the pseudo random number generation for shuffling the data for
|      probability estimates. Ignored when `probability` is False.
|      Pass an int for reproducible output across multiple function calls.
|      See :term:`Glossary <random_state>`.
|
|  Attributes
|  ----------
|  class_weight_ : ndarray of shape (n_classes,)
|      Multipliers of parameter C for each class.
|      Computed based on the ``class_weight`` parameter.
|
|  classes_ : ndarray of shape (n_classes,)
|      The classes labels.
|
|  coef_ : ndarray of shape (n_classes * (n_classes - 1) / 2, n_features)
|      Weights assigned to the features (coefficients in the primal
|      problem). This is only available in the case of a linear kernel.
|
|      `coef_` is a readonly property derived from `dual_coef_` and
|      `support_vectors_`.
|
|  dual_coef_ : ndarray of shape (n_classes -1, n_SV)
|      Dual coefficients of the support vector in the decision
|      function (see :ref:`sgd_mathematical_formulation`), multiplied by
|      their targets.
|      For multiclass, coefficient for all 1-vs-1 classifiers.
|      The layout of the coefficients in the multiclass case is somewhat
|      non-trivial. See the :ref:`multi-class section of the User Guide
|      <svm_multi_class>` for details.
|
|  fit_status_ : int
|      0 if correctly fitted, 1 otherwise (will raise warning)
|
|  intercept_ : ndarray of shape (n_classes * (n_classes - 1) / 2,)
|      Constants in decision function.
|
|  n_features_in_ : int
|      Number of features seen during :term:`fit`.
|
|      .. versionadded:: 0.24
|
```

```
|  feature_names_in_ : ndarray of shape (`n_features_in_`,)
|      Names of features seen during :term:`fit`. Defined only when `X`
|      has feature names that are all strings.
|
|      .. versionadded:: 1.0
|
|  n_iter_ : ndarray of shape (n_classes * (n_classes - 1) // 2,)
|      Number of iterations run by the optimization routine to fit the model.
|      The shape of this attribute depends on the number of models optimized
|      which in turn depends on the number of classes.
|
|      .. versionadded:: 1.1
|
|  support_ : ndarray of shape (n_SV)
|      Indices of support vectors.
|
|  support_vectors_ : ndarray of shape (n_SV, n_features)
|      Support vectors. An empty array if kernel is precomputed.
|
|  n_support_ : ndarray of shape (n_classes,), dtype=int32
|      Number of support vectors for each class.
|
|  probA_ : ndarray of shape (n_classes * (n_classes - 1) / 2)
|  probB_ : ndarray of shape (n_classes * (n_classes - 1) / 2)
|      If `probability=True`, it corresponds to the parameters learned in
|      Platt scaling to produce probability estimates from decision values.
|      If `probability=False`, it's an empty array. Platt scaling uses the
|      logistic function
|      ``1 / (1 + exp(decision_value * probA_ + probB_))``
|      where ``probA_`` and ``probB_`` are learned from the dataset [2]_. For
|      more information on the multiclass case and training procedure see
|      section 8 of [1]_.
|
|  shape_fit_ : tuple of int of shape (n_dimensions_of_X,)
|      Array dimensions of training vector ``X``.
|
|  See Also
|  --------
|  SVR : Support Vector Machine for Regression implemented using libsvm.
|
|  LinearSVC : Scalable Linear Support Vector Machine for classification
|      implemented using liblinear. Check the See Also section of
|      LinearSVC for more comparison element.
|
|  References
|  ----------
|  .. [1] `LIBSVM: A Library for Support Vector Machines
|      <http://www.csie.ntu.edu.tw/~cjlin/papers/libsvm.pdf>`_
|
|  .. [2] `Platt, John (1999). "Probabilistic Outputs for Support Vector
|      Machines and Comparisons to Regularized Likelihood Methods"
|      <https://citeseerx.ist.psu.edu/doc_view/pid/42e5ed832d4310ce4378c44d05570439
df28a393>`_
|
|  Examples
|  --------
```

```
 |  >>> import numpy as np
 |  >>> from sklearn.pipeline import make_pipeline
 |  >>> from sklearn.preprocessing import StandardScaler
 |  >>> X = np.array([[-1, -1], [-2, -1], [1, 1], [2, 1]])
 |  >>> y = np.array([1, 1, 2, 2])
 |  >>> from sklearn.svm import SVC
 |  >>> clf = make_pipeline(StandardScaler(), SVC(gamma='auto'))
 |  >>> clf.fit(X, y)
 |  Pipeline(steps=[('standardscaler', StandardScaler()),
 |                  ('svc', SVC(gamma='auto'))])
 |
 |  >>> print(clf.predict([[-0.8, -1]]))
 |  [1]
 |
 |  Method resolution order:
 |      SVC
 |      sklearn.svm._base.BaseSVC
 |      sklearn.base.ClassifierMixin
 |      sklearn.svm._base.BaseLibSVM
 |      sklearn.base.BaseEstimator
 |      sklearn.utils._estimator_html_repr._HTMLDocumentationLinkMixin
 |      sklearn.utils._metadata_requests._MetadataRequester
 |      builtins.object
 |
 |  Methods defined here:
 |
 |  __init__(self, *, C=1.0, kernel='rbf', degree=3, gamma='scale', coef0=0.0, shrin
king=True, probability=False, tol=0.001, cache_size=200, class_weight=None, verbose=
False, max_iter=-1, decision_function_shape='ovr', break_ties=False, random_state=No
ne)
 |      Initialize self.  See help(type(self)) for accurate signature.
 |
 |  set_fit_request(self: sklearn.svm._classes.SVC, *, sample_weight: Union[bool, No
neType, str] = '$UNCHANGED$') -> sklearn.svm._classes.SVC
 |      Request metadata passed to the ``fit`` method.
 |
 |      Note that this method is only relevant if
 |      ``enable_metadata_routing=True`` (see :func:`sklearn.set_config`).
 |      Please see :ref:`User Guide <metadata_routing>` on how the routing
 |      mechanism works.
 |
 |      The options for each parameter are:
 |
 |      - ``True``: metadata is requested, and passed to ``fit`` if provided. The re
quest is ignored if metadata is not provided.
 |
 |      - ``False``: metadata is not requested and the meta-estimator will not pass
it to ``fit``.
 |
 |      - ``None``: metadata is not requested, and the meta-estimator will raise an
error if the user provides it.
 |
 |      - ``str``: metadata should be passed to the meta-estimator with this given a
lias instead of the original name.
 |
 |      The default (``sklearn.utils.metadata_routing.UNCHANGED``) retains the
```

```
 |      existing request. This allows you to change the request for some
 |      parameters and not others.
 |
 |      .. versionadded:: 1.3
 |
 |      .. note::
 |          This method is only relevant if this estimator is used as a
 |          sub-estimator of a meta-estimator, e.g. used inside a
 |          :class:`~sklearn.pipeline.Pipeline`. Otherwise it has no effect.
 |
 |      Parameters
 |      ----------
 |      sample_weight : str, True, False, or None,                     default=sklea
rn.utils.metadata_routing.UNCHANGED
 |          Metadata routing for ``sample_weight`` parameter in ``fit``.
 |
 |      Returns
 |      -------
 |      self : object
 |          The updated object.
 |
 |  set_score_request(self: sklearn.svm._classes.SVC, *, sample_weight: Union[bool,
NoneType, str] = '$UNCHANGED$') -> sklearn.svm._classes.SVC
 |      Request metadata passed to the ``score`` method.
 |
 |      Note that this method is only relevant if
 |      ``enable_metadata_routing=True`` (see :func:`sklearn.set_config`).
 |      Please see :ref:`User Guide <metadata_routing>` on how the routing
 |      mechanism works.
 |
 |      The options for each parameter are:
 |
 |      - ``True``: metadata is requested, and passed to ``score`` if provided. The
request is ignored if metadata is not provided.
 |
 |      - ``False``: metadata is not requested and the meta-estimator will not pass
it to ``score``.
 |
 |      - ``None``: metadata is not requested, and the meta-estimator will raise an
error if the user provides it.
 |
 |      - ``str``: metadata should be passed to the meta-estimator with this given a
lias instead of the original name.
 |
 |      The default (``sklearn.utils.metadata_routing.UNCHANGED``) retains the
 |      existing request. This allows you to change the request for some
 |      parameters and not others.
 |
 |      .. versionadded:: 1.3
 |
 |      .. note::
 |          This method is only relevant if this estimator is used as a
 |          sub-estimator of a meta-estimator, e.g. used inside a
 |          :class:`~sklearn.pipeline.Pipeline`. Otherwise it has no effect.
 |
 |      Parameters
```

```
 |      ----------
 |      sample_weight : str, True, False, or None,                     default=sklea
rn.utils.metadata_routing.UNCHANGED
 |          Metadata routing for ``sample_weight`` parameter in ``score``.
 |
 |      Returns
 |      -------
 |      self : object
 |          The updated object.
 |
 |  ----------------------------------------------------------------------
 |  Data and other attributes defined here:
 |
 |  __abstractmethods__ = frozenset()
 |
 |  __annotations__ = {}
 |
 |  ----------------------------------------------------------------------
 |  Methods inherited from sklearn.svm._base.BaseSVC:
 |
 |  decision_function(self, X)
 |      Evaluate the decision function for the samples in X.
 |
 |      Parameters
 |      ----------
 |      X : array-like of shape (n_samples, n_features)
 |          The input samples.
 |
 |      Returns
 |      -------
 |      X : ndarray of shape (n_samples, n_classes * (n_classes-1) / 2)
 |          Returns the decision function of the sample for each class
 |          in the model.
 |          If decision_function_shape='ovr', the shape is (n_samples,
 |          n_classes).
 |
 |      Notes
 |      -----
 |      If decision_function_shape='ovo', the function values are proportional
 |      to the distance of the samples X to the separating hyperplane. If the
 |      exact distances are required, divide the function values by the norm of
 |      the weight vector (``coef_``). See also `this question
 |      <https://stats.stackexchange.com/questions/14876/
 |      interpreting-distance-from-hyperplane-in-svm>`_ for further details.
 |      If decision_function_shape='ovr', the decision function is a monotonic
 |      transformation of ovo decision function.
 |
 |  predict(self, X)
 |      Perform classification on samples in X.
 |
 |      For an one-class model, +1 or -1 is returned.
 |
 |      Parameters
 |      ----------
 |      X : {array-like, sparse matrix} of shape (n_samples, n_features) or
(n_samples_test, n_samples_train)
```

```
|          For kernel="precomputed", the expected shape of X is
|          (n_samples_test, n_samples_train).
|
|      Returns
|      -------
|      y_pred : ndarray of shape (n_samples,)
|          Class labels for samples in X.
|
|  predict_log_proba(self, X)
|      Compute log probabilities of possible outcomes for samples in X.
|
|      The model need to have probability information computed at training
|      time: fit with attribute `probability` set to True.
|
|      Parameters
|      ----------
|      X : array-like of shape (n_samples, n_features) or                 (n_sample
s_test, n_samples_train)
|          For kernel="precomputed", the expected shape of X is
|          (n_samples_test, n_samples_train).
|
|      Returns
|      -------
|      T : ndarray of shape (n_samples, n_classes)
|          Returns the log-probabilities of the sample for each class in
|          the model. The columns correspond to the classes in sorted
|          order, as they appear in the attribute :term:`classes_`.
|
|      Notes
|      -----
|      The probability model is created using cross validation, so
|      the results can be slightly different than those obtained by
|      predict. Also, it will produce meaningless results on very small
|      datasets.
|
|  predict_proba(self, X)
|      Compute probabilities of possible outcomes for samples in X.
|
|      The model needs to have probability information computed at training
|      time: fit with attribute `probability` set to True.
|
|      Parameters
|      ----------
|      X : array-like of shape (n_samples, n_features)
|          For kernel="precomputed", the expected shape of X is
|          (n_samples_test, n_samples_train).
|
|      Returns
|      -------
|      T : ndarray of shape (n_samples, n_classes)
|          Returns the probability of the sample for each class in
|          the model. The columns correspond to the classes in sorted
|          order, as they appear in the attribute :term:`classes_`.
|
|      Notes
|      -----
```

```
|      The probability model is created using cross validation, so
|      the results can be slightly different than those obtained by
|      predict. Also, it will produce meaningless results on very small
|      datasets.
|
|  ----------------------------------------------------------------------
|  Readonly properties inherited from sklearn.svm._base.BaseSVC:
|
|  probA_
|      Parameter learned in Platt scaling when `probability=True`.
|
|      Returns
|      -------
|      ndarray of shape  (n_classes * (n_classes - 1) / 2)
|
|  probB_
|      Parameter learned in Platt scaling when `probability=True`.
|
|      Returns
|      -------
|      ndarray of shape  (n_classes * (n_classes - 1) / 2)
|
|  ----------------------------------------------------------------------
|  Data and other attributes inherited from sklearn.svm._base.BaseSVC:
|
|  unused_param = 'nu'
|
|  ----------------------------------------------------------------------
|  Methods inherited from sklearn.base.ClassifierMixin:
|
|  score(self, X, y, sample_weight=None)
|      Return the mean accuracy on the given test data and labels.
|
|      In multi-label classification, this is the subset accuracy
|      which is a harsh metric since you require for each sample that
|      each label set be correctly predicted.
|
|      Parameters
|      ----------
|      X : array-like of shape (n_samples, n_features)
|          Test samples.
|
|      y : array-like of shape (n_samples,) or (n_samples, n_outputs)
|          True labels for `X`.
|
|      sample_weight : array-like of shape (n_samples,), default=None
|          Sample weights.
|
|      Returns
|      -------
|      score : float
|          Mean accuracy of ``self.predict(X)`` w.r.t. `y`.
|
|  ----------------------------------------------------------------------
|  Data descriptors inherited from sklearn.base.ClassifierMixin:
|
```

```
 |  __dict__
 |      dictionary for instance variables
 |
 |  __weakref__
 |      list of weak references to the object
 |
 |  ----------------------------------------------------------------------
 |  Methods inherited from sklearn.svm._base.BaseLibSVM:
 |
 |  fit(self, X, y, sample_weight=None)
 |      Fit the SVM model according to the given training data.
 |
 |      Parameters
 |      ----------
 |      X : {array-like, sparse matrix} of shape (n_samples, n_features)
or (n_samples, n_samples)
 |          Training vectors, where `n_samples` is the number of samples
 |          and `n_features` is the number of features.
 |          For kernel="precomputed", the expected shape of X is
 |          (n_samples, n_samples).
 |
 |      y : array-like of shape (n_samples,)
 |          Target values (class labels in classification, real numbers in
 |          regression).
 |
 |      sample_weight : array-like of shape (n_samples,), default=None
 |          Per-sample weights. Rescale C per sample. Higher weights
 |          force the classifier to put more emphasis on these points.
 |
 |      Returns
 |      -------
 |      self : object
 |          Fitted estimator.
 |
 |      Notes
 |      -----
 |      If X and y are not C-ordered and contiguous arrays of np.float64 and
 |      X is not a scipy.sparse.csr_matrix, X and/or y may be copied.
 |
 |      If X is a dense array, then the other methods will not support sparse
 |      matrices as input.
 |
 |  ----------------------------------------------------------------------
 |  Readonly properties inherited from sklearn.svm._base.BaseLibSVM:
 |
 |  coef_
 |      Weights assigned to the features when `kernel="linear"`.
 |
 |      Returns
 |      -------
 |      ndarray of shape (n_features, n_classes)
 |
 |  n_support_
 |      Number of support vectors for each class.
 |
 |  ----------------------------------------------------------------------
```

```
|  Methods inherited from sklearn.base.BaseEstimator:
|
|  __getstate__(self)
|      Helper for pickle.
|
|  __repr__(self, N_CHAR_MAX=700)
|      Return repr(self).
|
|  __setstate__(self, state)
|
|  __sklearn_clone__(self)
|
|  get_params(self, deep=True)
|      Get parameters for this estimator.
|
|      Parameters
|      ----------
|      deep : bool, default=True
|          If True, will return the parameters for this estimator and
|          contained subobjects that are estimators.
|
|      Returns
|      -------
|      params : dict
|          Parameter names mapped to their values.
|
|  set_params(self, **params)
|      Set the parameters of this estimator.
|
|      The method works on simple estimators as well as on nested objects
|      (such as :class:`~sklearn.pipeline.Pipeline`). The latter have
|      parameters of the form ``<component>__<parameter>`` so that it's
|      possible to update each component of a nested object.
|
|      Parameters
|      ----------
|      **params : dict
|          Estimator parameters.
|
|      Returns
|      -------
|      self : estimator instance
|          Estimator instance.
|
|  ----------------------------------------------------------------------
|  Methods inherited from sklearn.utils._metadata_requests._MetadataRequester:
|
|  get_metadata_routing(self)
|      Get metadata routing of this object.
|
|      Please check :ref:`User Guide <metadata_routing>` on how the routing
|      mechanism works.
|
|      Returns
|      -------
|      routing : MetadataRequest
```

```
|          A :class:`~sklearn.utils.metadata_routing.MetadataRequest` encapsulating
|          routing information.
|
|  ----------------------------------------------------------------------
|  Class methods inherited from sklearn.utils._metadata_requests._MetadataRequeste
r:
|
|  __init_subclass__(**kwargs) from abc.ABCMeta
|      Set the ``set_{method}_request`` methods.
|
|      This uses PEP-487 [1]_ to set the ``set_{method}_request`` methods. It
|      looks for the information available in the set default values which are
|      set using ``__metadata_request__*`` class attributes, or inferred
|      from method signatures.
|
|      The ``__metadata_request__*`` class attributes are used when a method
|      does not explicitly accept a metadata through its arguments or if the
|      developer would like to specify a request value for those metadata
|      which are different from the default ``None``.
|
|      References
|      ----------
|      .. [1] https://www.python.org/dev/peps/pep-0487
```

In [11]:
```
y = df['Virus Present']
```

In [12]:
```
X = df.drop('Virus Present',axis=1)
```

In [13]:
```
model = SVC(kernel='linear', C=1000)
model.fit(X,y)
```

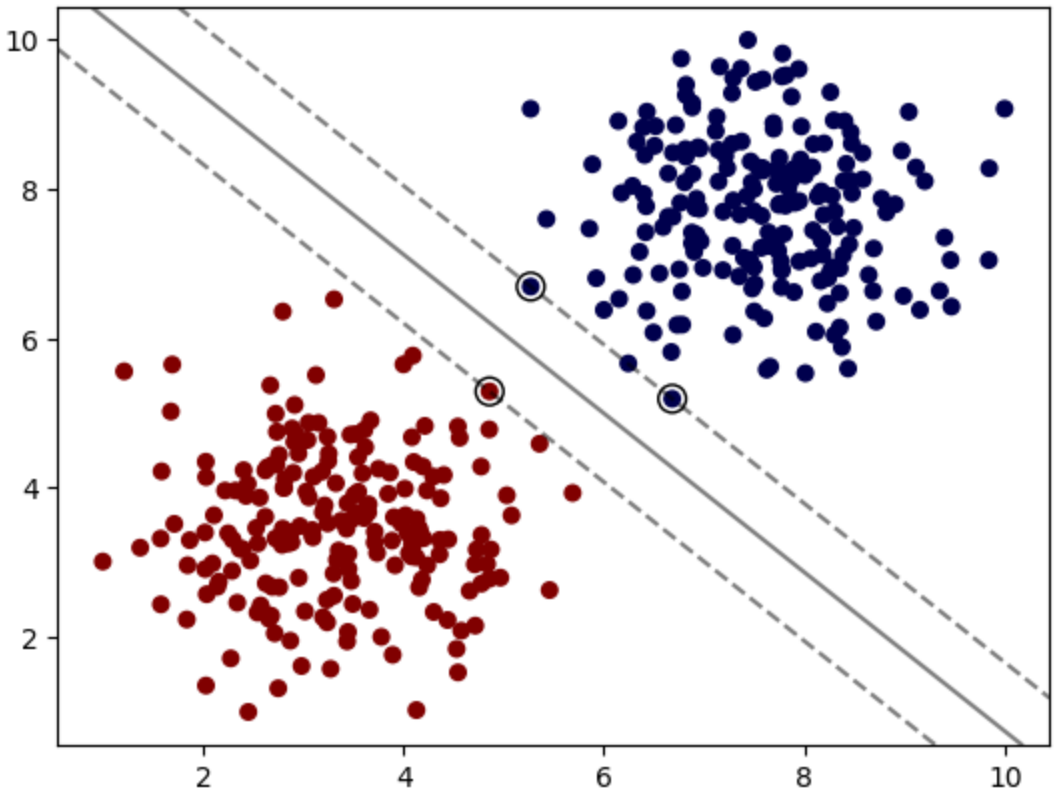
Out[13]:
```
▾          SVC          i ?

SVC(C=1000, kernel='linear')
```

In [14]:
```
from svm_margin_plot import plot_svm_boundary
```

In [15]:
```
plot_svm_boundary(model, X, y)
```

```
C:\Users\viorel\miniconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X doe
s not have valid feature names, but SVC was fitted with feature names
  warnings.warn(
```



In [16]:
```
model = SVC(kernel='linear', C=0.05)
model.fit(X,y)
```

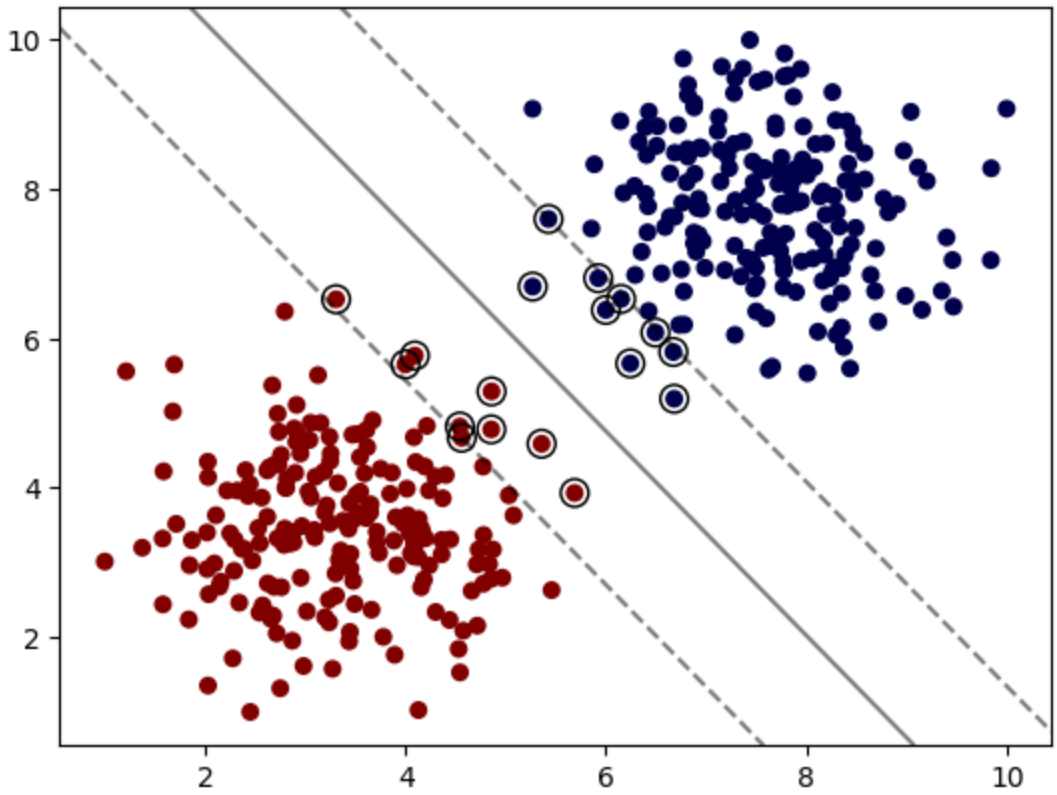
Out[16]:

SVC

```
SVC(C=0.05, kernel='linear')
```

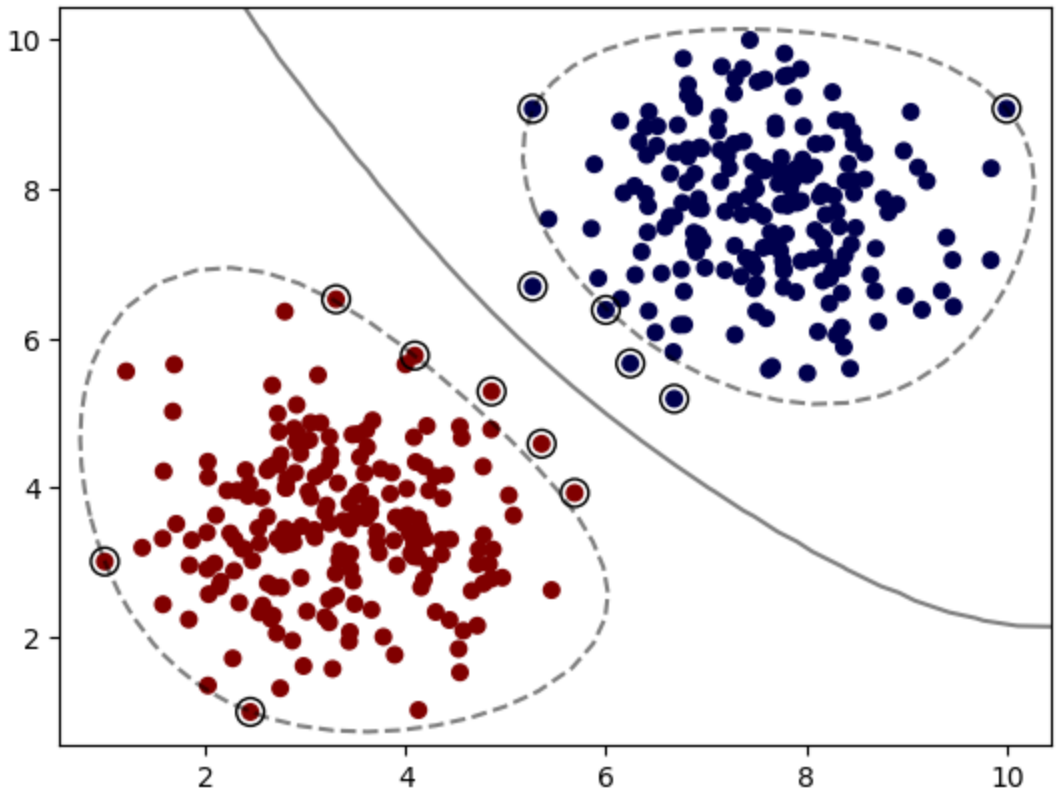
In [17]:
```
plot_svm_boundary(model, X, y)
```

```
C:\Users\viorel\miniconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X doe
s not have valid feature names, but SVC was fitted with feature names
  warnings.warn(
```



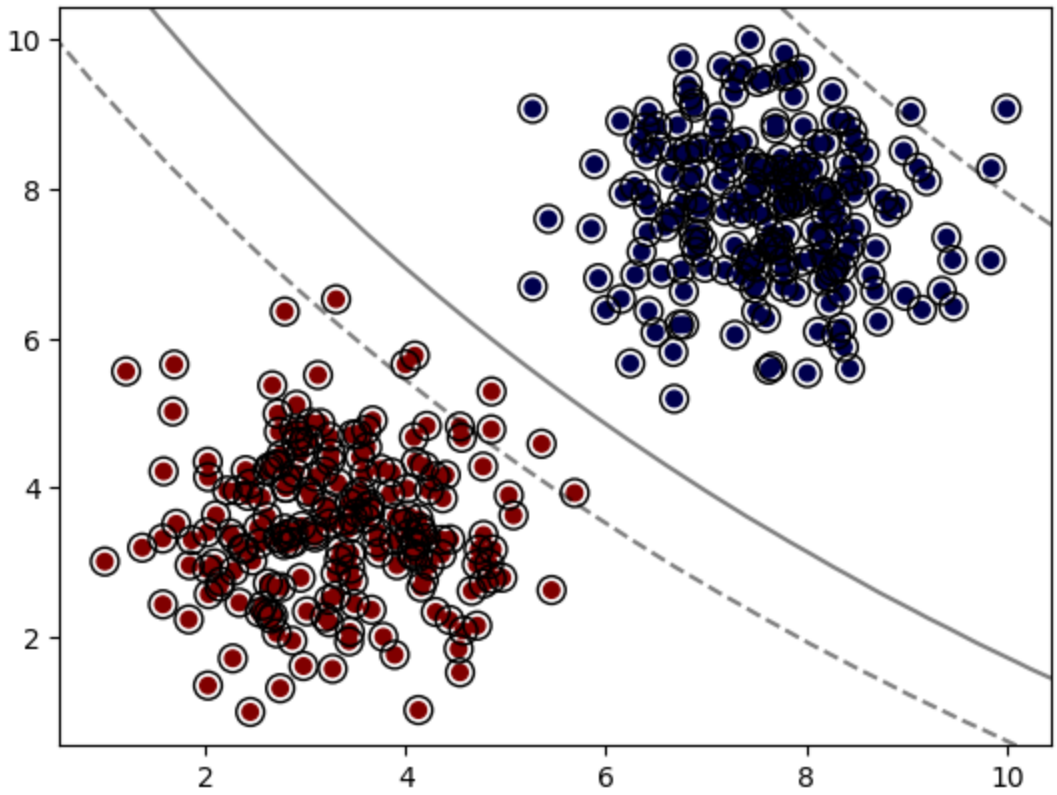
In [18]:
```
model = SVC(kernel='rbf', C=1)
model.fit(X,y)
plot_svm_boundary(model, X, y)
```

```
C:\Users\viorel\miniconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X doe
s not have valid feature names, but SVC was fitted with feature names
  warnings.warn(
```



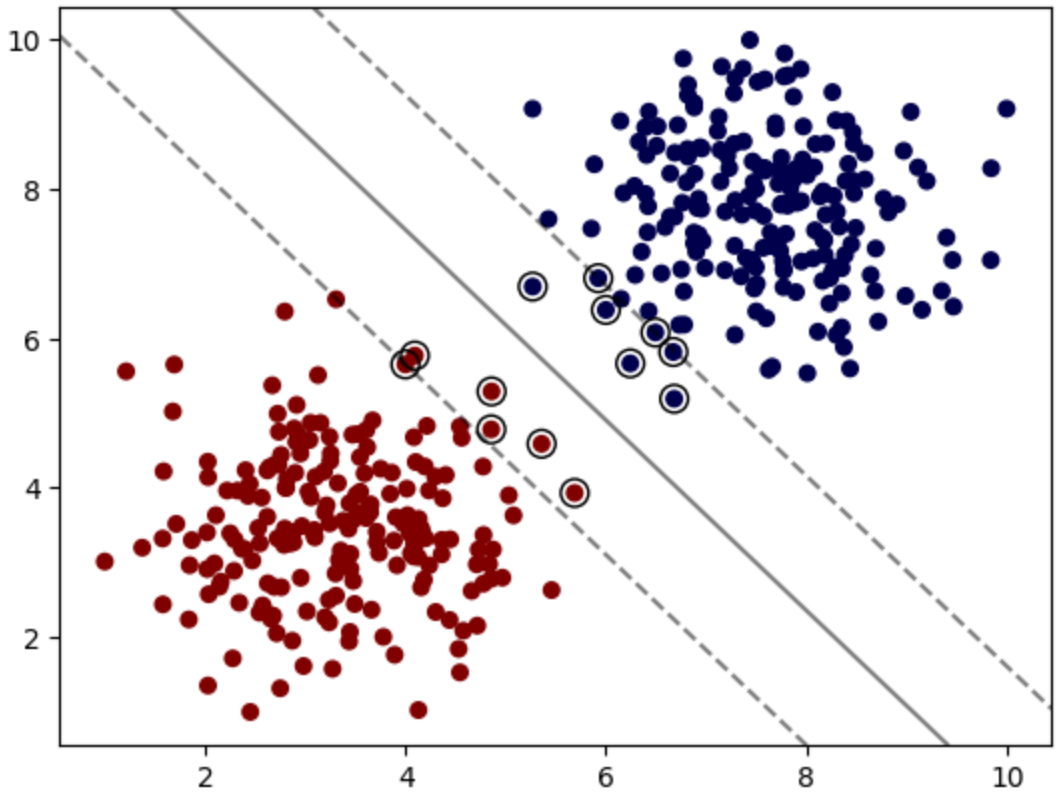
In [23]:
```
model = SVC(kernel='sigmoid', C=1)
model.fit(X,y)
plot_svm_boundary(model, X, y)
```

```
C:\Users\viorel\miniconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X doe
s not have valid feature names, but SVC was fitted with feature names
  warnings.warn(
```



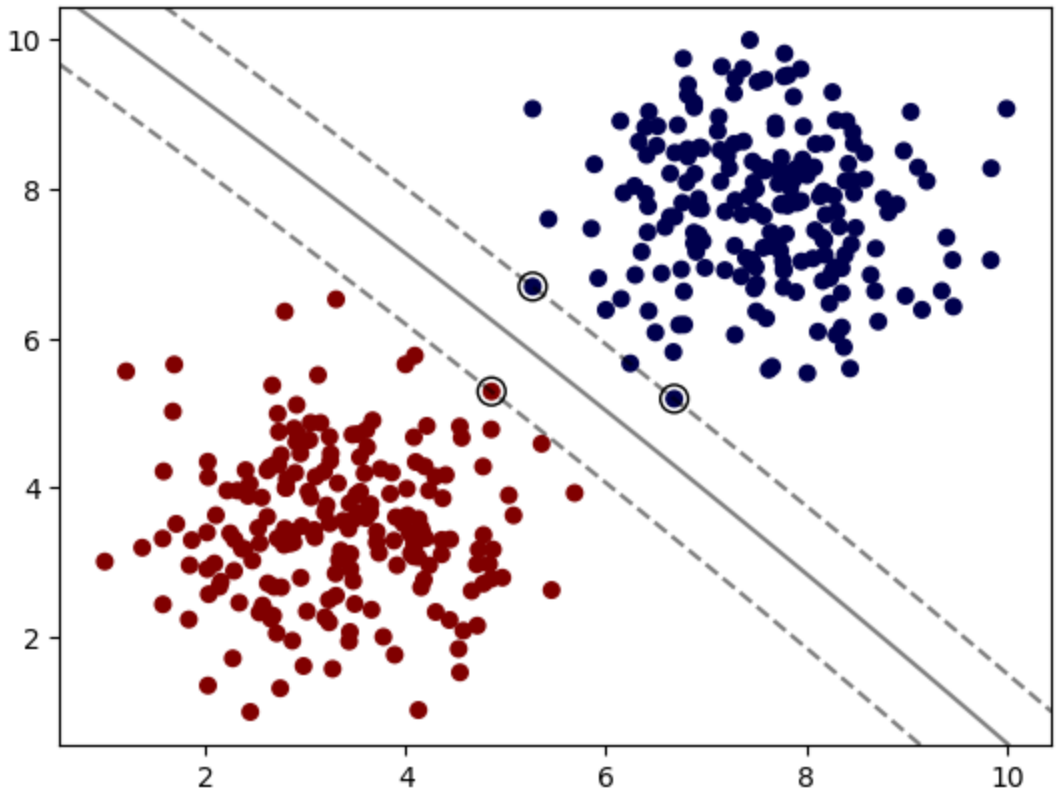
In [24]:
```
model = SVC(kernel='poly', C=1, degree=1)
model.fit(X,y)
plot_svm_boundary(model, X, y)
```

```
C:\Users\viorel\miniconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X doe
s not have valid feature names, but SVC was fitted with feature names
  warnings.warn(
```



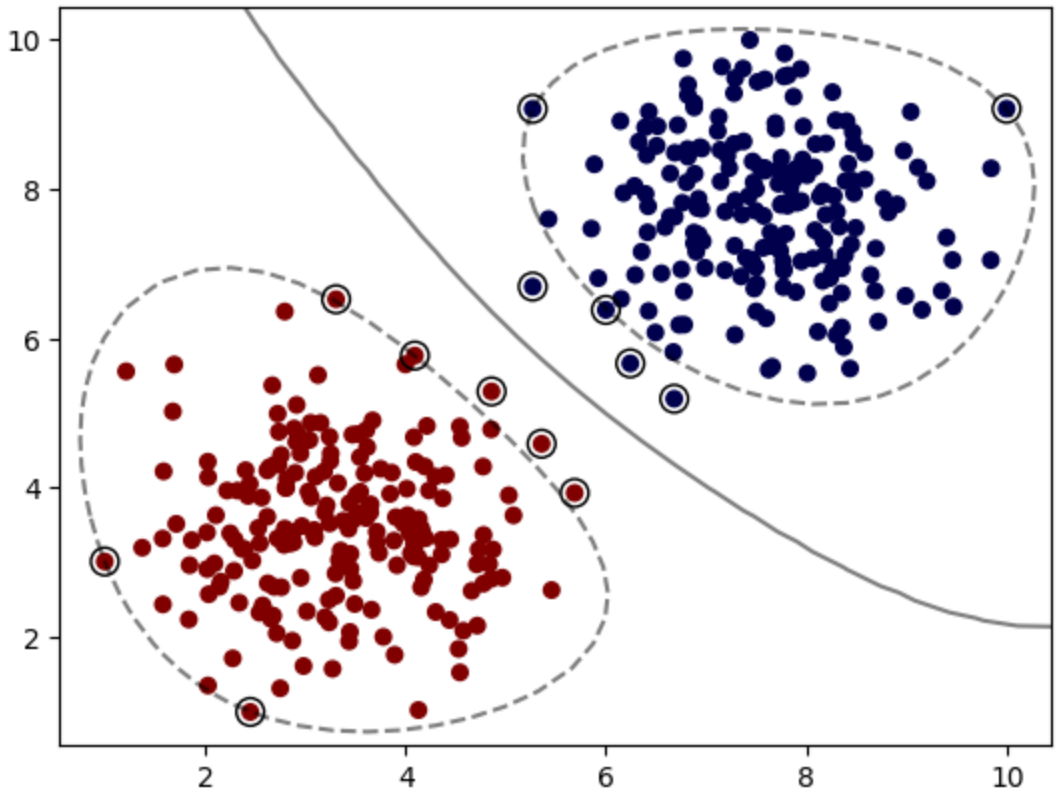
In [25]:
```
model = SVC(kernel='poly', C=1, degree=2)
model.fit(X,y)
plot_svm_boundary(model, X, y)
```

```
C:\Users\viorel\miniconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X doe
s not have valid feature names, but SVC was fitted with feature names
  warnings.warn(
```



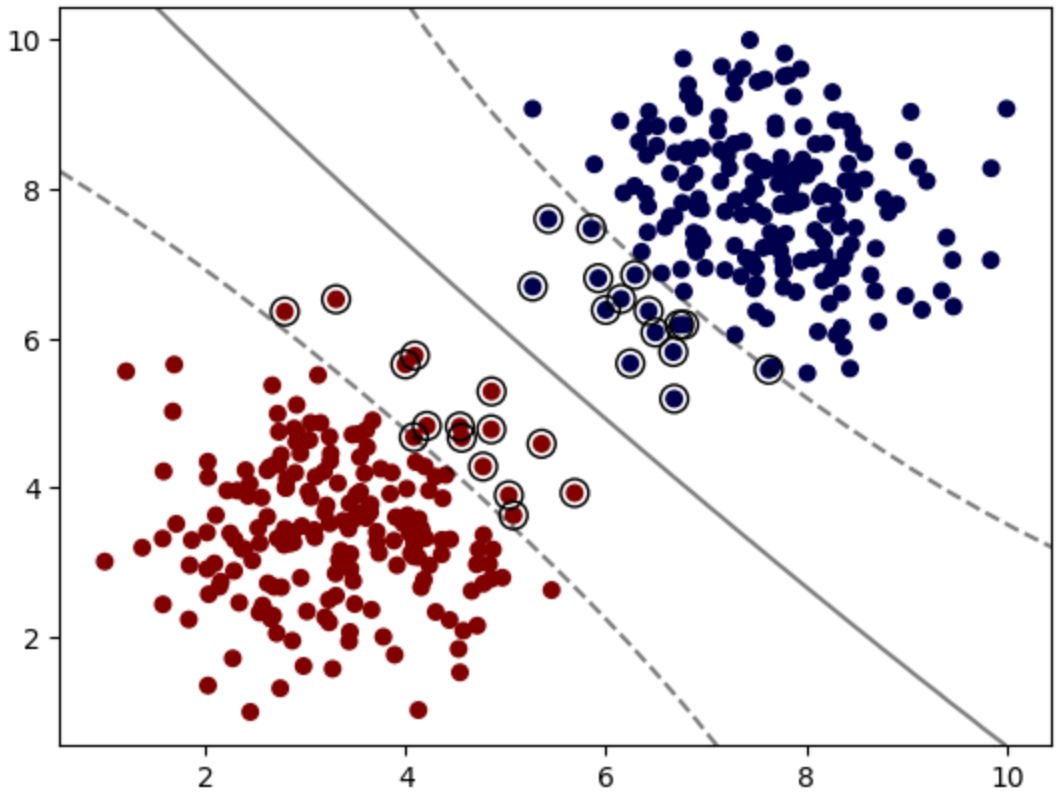
In [26]:
```
model = SVC(kernel='rbf', C=1)
model.fit(X,y)
plot_svm_boundary(model, X, y)
```

```
C:\Users\viorel\miniconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X doe
s not have valid feature names, but SVC was fitted with feature names
  warnings.warn(
```



In [30]:
```
model = SVC(kernel='rbf', C=1, gamma=0.01)
model.fit(X,y)
plot_svm_boundary(model, X, y)
```

```
C:\Users\viorel\miniconda3\Lib\site-packages\sklearn\base.py:493: UserWarning: X doe
s not have valid feature names, but SVC was fitted with feature names
  warnings.warn(
```



In [ ]: