f (https://www.facebook.com/AnalyticsVidhya) | **y** (https://twitter.com/analyticsvidhya)

g+ (https://plus.google.com/+Analyticsvidhya/posts)

in (https://www.linkedin.com/groups/Analytics-Vidhya-Learn-everything-about-5057165) |

≡ |

Analytics Vidhya
Learn Everything About Analytics (http://www.analyticsvidhya.com)

(http://datahack.analyticsvidhya.com/contest/date-your-data)

Home (http://www.analyticsvidhya.com/) » Business Analytics (http://www.analyticsvidhya.com/blog/category/business-

REPLY (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=48270#RESPOND)

Support Vector Machine - Simplified

BUSINESS ANALYTICS (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/CATEGORY/BUSINESS-ANALYTICS/)

SHARE **f** (http://www.facebook.com/sharer.php?u=http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/&t=Support%20Vector%20Machine%20-%20Simplified) **y** (https://twitter.com/home?status=Support%20Vector%20Machine%20-%20Simplified+http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/) **g+** (https://plus.google.com/share?url=http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/) **P** (http://pinterest.com/pin/create/button/?url=http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/&media=http://www.analyticsvidhya.com/wp-content/uploads/2014/10/Basic-concepts-of-Support-Vector-Machines-SVM.jpg&description=Support%20Vector%20Machine%20-%20Simplified)
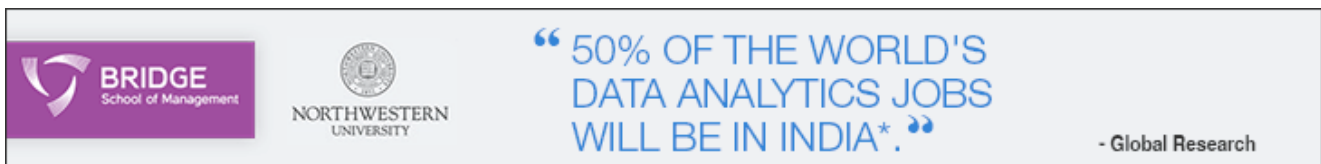
The first time I heard the name "Support Vector Machine", I felt, if the name itself sounds so complicated the formulation of the concept will be beyond my understanding. Luckily, I saw a few university lecture videos and realized how easy and effective this tool was. In this article, we will talk about how support vector machine works. **This article is suitable for readers who do not know much about this algorithm and have a curiosity to learn a new technique**. In following articles we will explore the technique in detail and analyze cases where such techniques are stronger than other techniques.


(http://i1.wp.com/www.analyticsvidhya.com/wp-content/uploads/2014/10/Basic-concepts-of-Support-Vector-Machines-SVM.jpg)
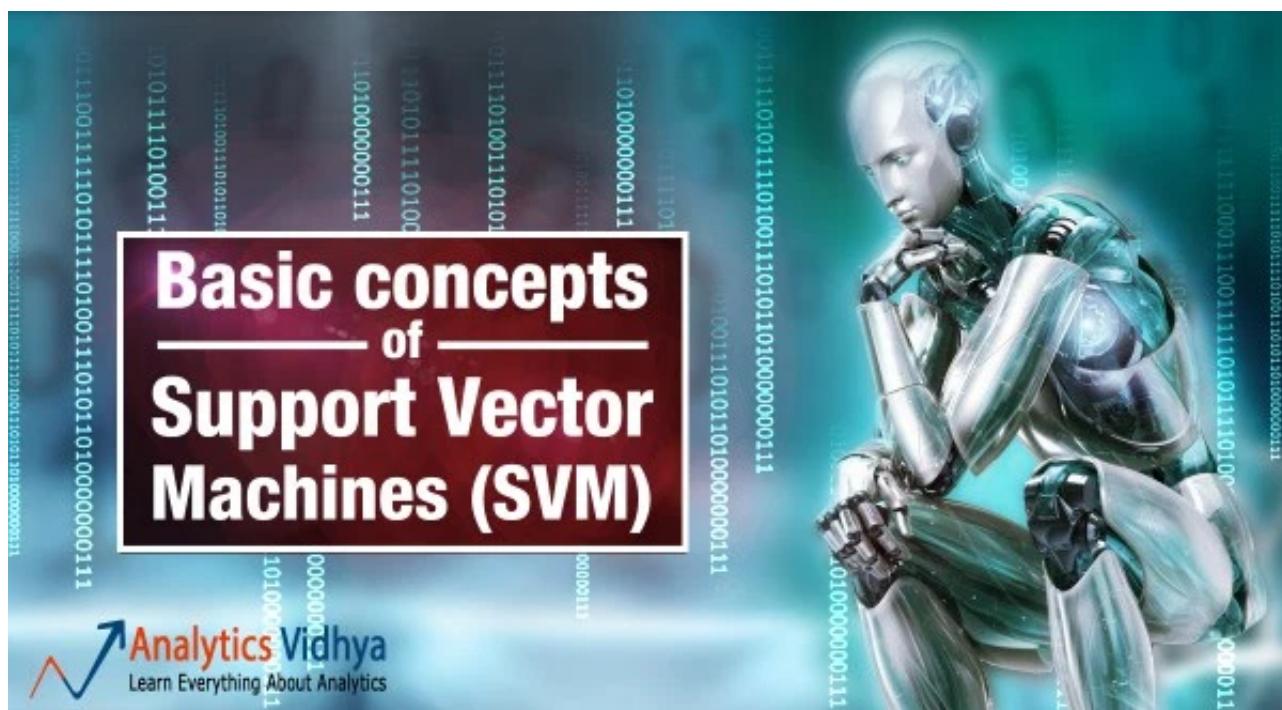
What is a classification analysis?

Let's consider an example to understand these concepts. We have a population composed of 50%-50% Males and Females. Using a sample of this population, you want to create some set of rules which will guide us the gender class for rest of the population. Using this algorithm, we intend to build a robot which can identify whether a person is a Male or a Female. This is a sample problem of classification analysis. Using some set of rules, we will try to classify the

population into two possible segments. For simplicity, let's assume that the two differentiating factors identified are : Height of the individual and Hair Length. Following is a scatter plot of the sample.
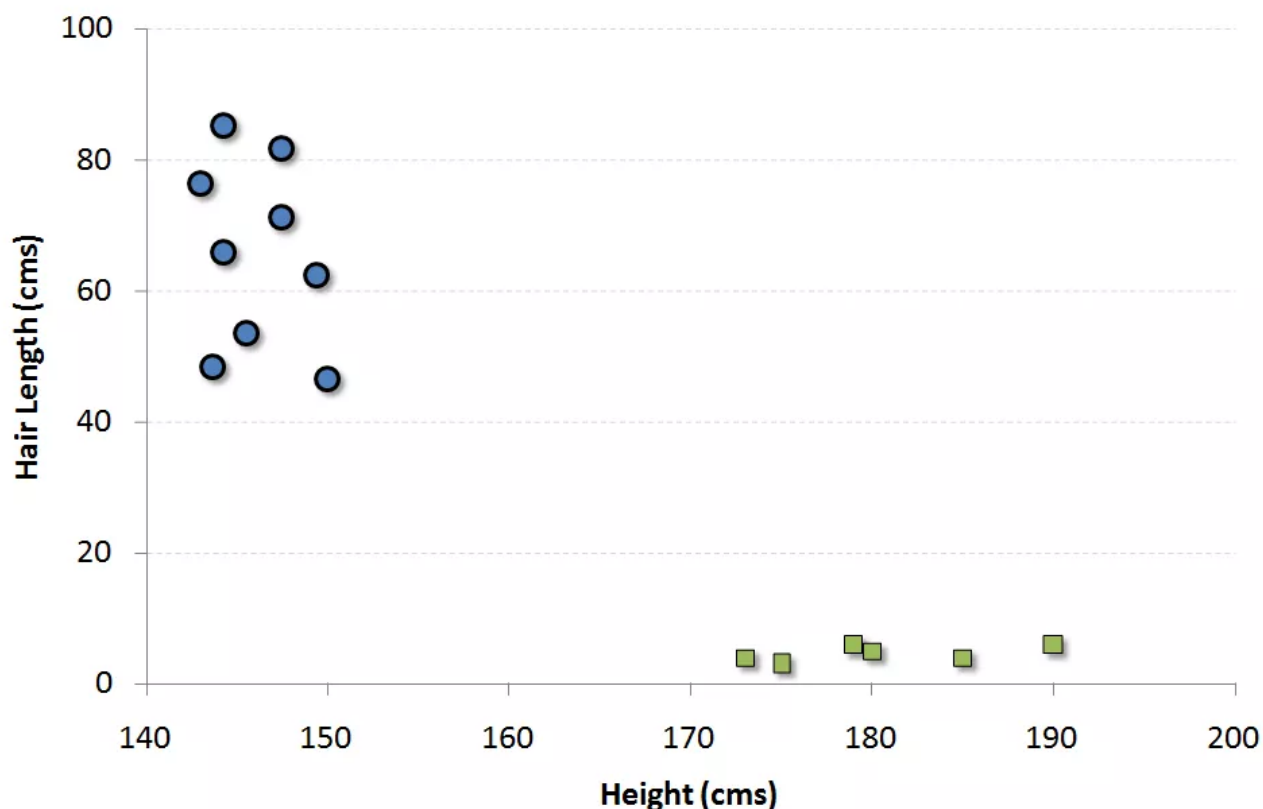
(http://i0.wp.com/www.analyticsvidhya.com/blog/wp-content/uploads/2014/10/xyplot.png)The blue circles in the plot represent females and green squares represents male. A few expected insights from the graph are :

1. Males in our population have a higher average height.

2. Females in our population have longer scalp hairs.

If we were to see an individual with height 180 cms and hair length 4 cms, our best guess will be to classify this individual as a male. This is how we do a classification analysis.

What is a Support Vector and what is SVM?

Support Vectors are simply the co-ordinates of individual observation. For instance, (45,150) is a support vector which corresponds to a female. Support Vector Machine is a frontier which best segregates the Male from the Females. In this case, the two classes are well separated from each other, hence it is easier to find a SVM.

How to find the Support Vector Machine for case in hand?

There are many possible frontier which can classify the problem in hand. Following are the three possible frontiers.


(http://i0.wp.com/www.analyticsvidhya.com/blog/wp-content/uploads/2014/10/xyplot1.png)
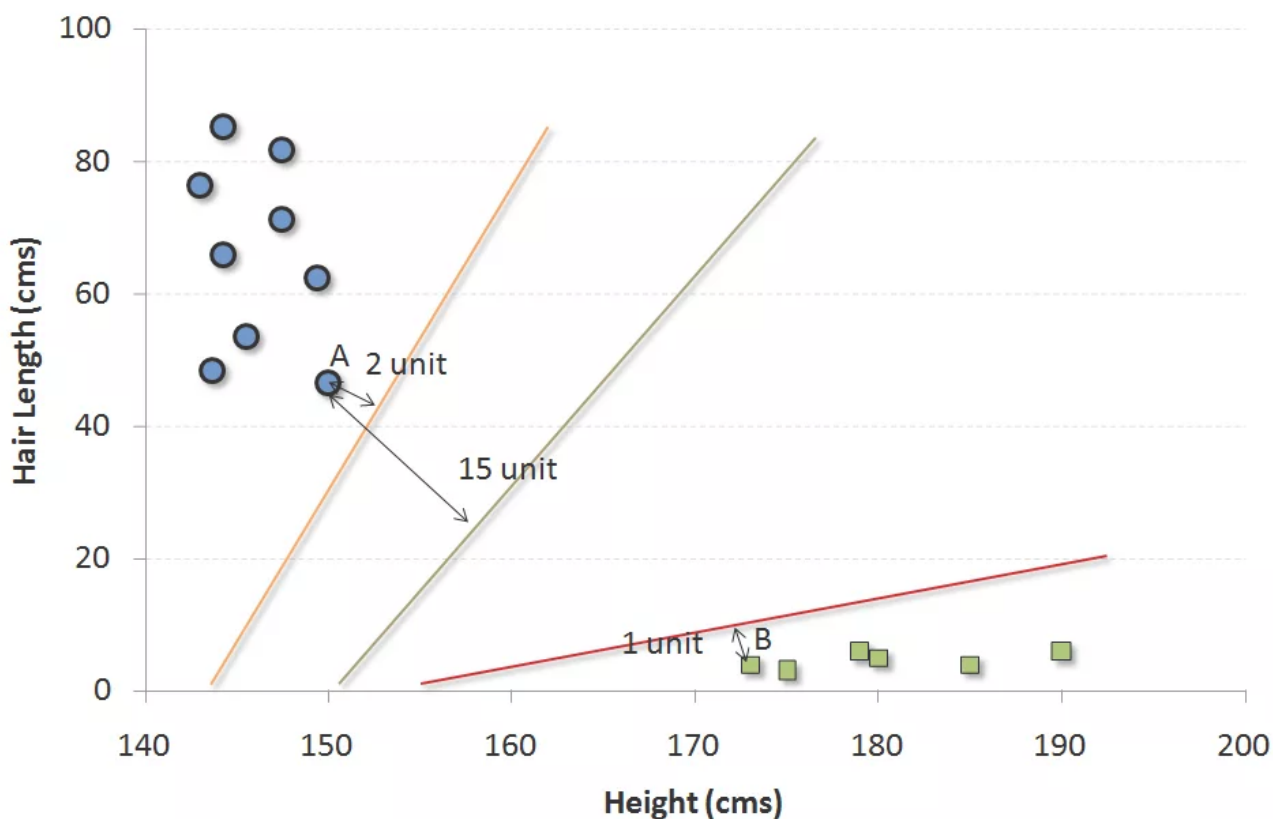
How do we decide which is the best frontier for this particular problem statement?

The easiest way to interpret the objective function in a SVM is to find the minimum distance of the frontier from closest support vector (this can belong to any class). For instance, orange frontier is closest to blue circles. And the closest blue circle is 2 units away from the frontier. Once we have these distances for all the frontiers, we simply choose the frontier with the maximum distance (from the closest support vector). Out of the three shown frontiers, we see the black frontier is farthest from nearest support vector (i.e. 15 units).

What if we do not find a clean frontier which segregates the classes?

Our job was relatively easier finding the SVM in this business case. What if the distribution looked something like as follows :

(http://i2.wp.com/www.analyticsvidhya.com/blog/wp-content/uploads/2014/10/xyplot2.png)
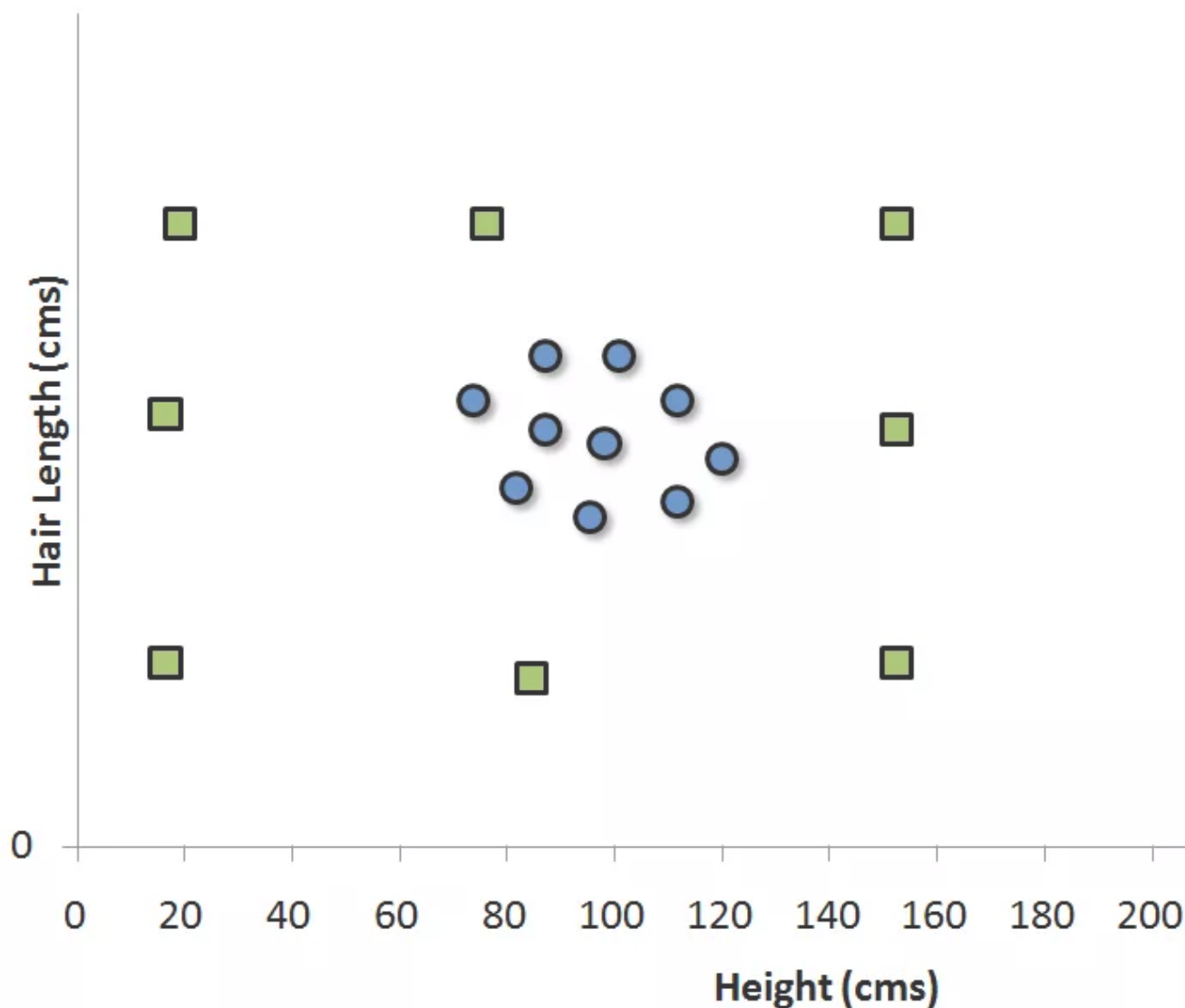
In such cases, we do not see a straight line frontier directly in current plane which can serve as the SVM. In such cases, we need to map these vector to a higher dimension plane so that they get segregated from each other. Such cases will be covered once we start with the formulation of SVM. For now, you can visualize that such transformation will result into following type of SVM.

(http://i1.wp.com/www.analyticsvidhya.com/blog/wp-content/uploads/2014/10/xyplot3.png)
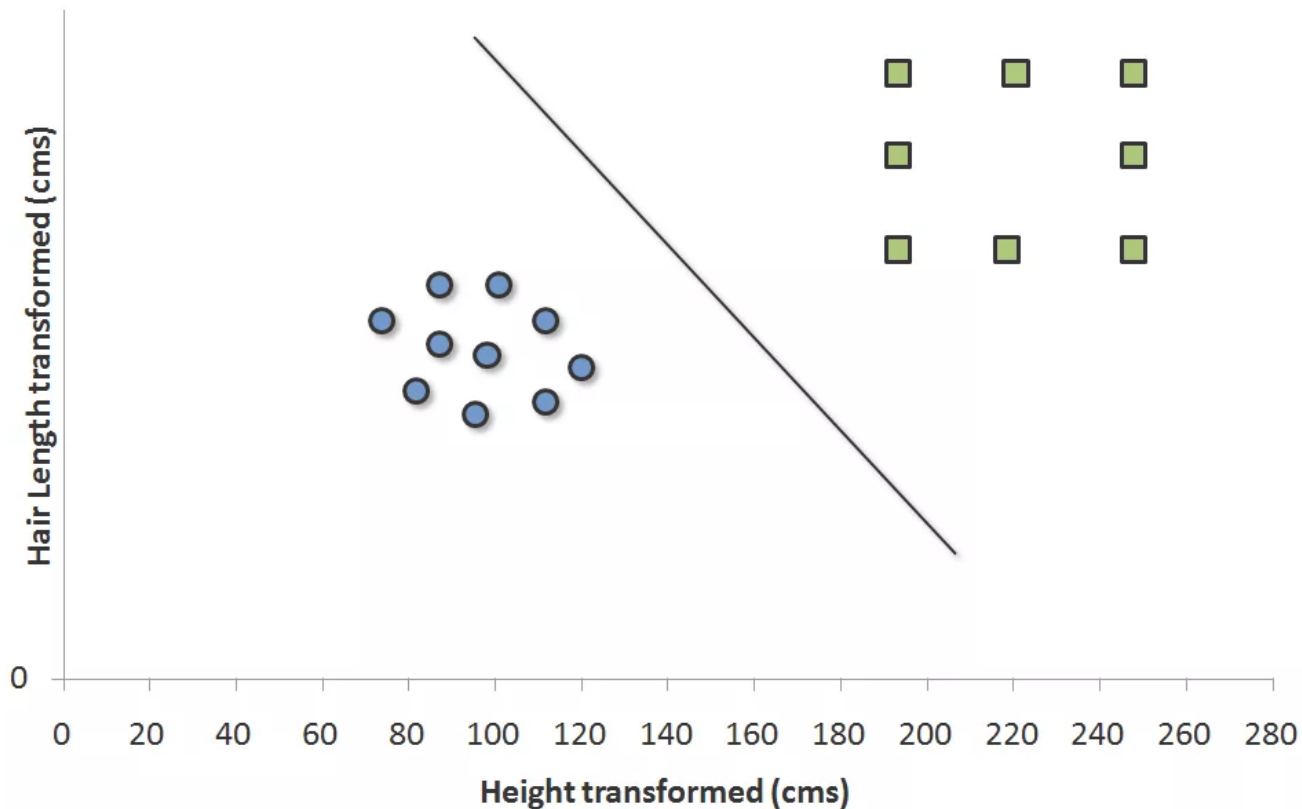
Each of the green square in original distribution is mapped on a transformed scale. And transformed scale has clearly segregated classes. Many algorithms have been proposed to make these transformations and some of which will be discussed in following articles.

End Notes

Support Vector Machines are very powerful classification algorithm. When used in conjunction with random forest and other machine learning tools, they give a very different dimension to ensemble models. Hence, they become very crucial for cases where very high predictive power is required. Such algorithms are slightly harder to visualize because of the complexity in formulation. You will find these algorithm very useful to solve some of the Kaggle problem statement.

Did you find the article useful? Have you used any other machine learning tool recently? How do you think SVM is different when compared to CART/CHAID models? Do you plan to use SVM in any of your business problems? If yes, share with us how you plan to go about it.

If you like what you just read & want to continue your analytics learning, subscribe to our emails (http://feedburner.google.com/fb/a/mailverify? uri=analyticsvidhya), follow us on twitter (http://twitter.com/analyticsvidhya) or like our facebook page (http://facebook.com/analyticsvidhya).

Share this:

in (http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/?share=linkedin&nb=1)
38

f (http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/?share=facebook&nb=1)
325

G+ (http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/?share=google-plus-1&nb=1)

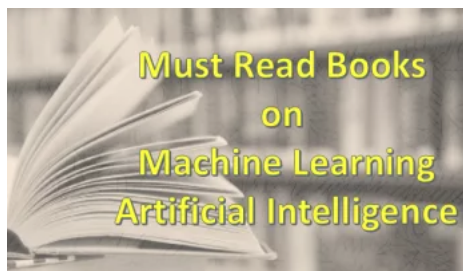(http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/?share=twitter&nb=1)

(http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/?share=pocket&nb=1)

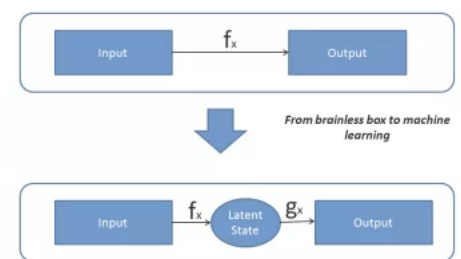(http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/?share=reddit&nb=1)

RELATED

(http://www.analyticsvidhya.com /blog/2015/10/understaing-

(http://www.analyticsvidhya.com /blog/2015/10/read-books-for-

(http://www.analyticsvidhya.com /blog/2014/10/introduction-

support-vector-machine-example-code/)
Understanding Support Vector Machine algorithm from examples (along with code) (http://www.analyticsvidhya.com /blog/2015/10/understaing-support-vector-machine-example-code/)

In "Business Analytics"

beginners-machine-learning-artificial-intelligence/)
Must Read Books for Beginners on Machine Learning and Artificial Intelligence (http://www.analyticsvidhya.com /blog/2015/10/read-books-for-beginners-machine-learning-artificial-intelligence/)

In "Business Analytics"

neural-network-simplified/)
Introduction to Artificial Neural Network : Simplified (http://www.analyticsvidhya.com /blog/2014/10/introduction-neural-network-simplified/)

In "Big data"

TAGS: ENSEMBLE MODEL (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/TAG/ENSEMBLE-MODEL/), KAGGLE (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/TAG/KAGGLE/), MACHINE LEARNING (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/TAG/MACHINE-LEARNING/), R (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/TAG/R/), SUPPORT VECTOR MACHINE (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/TAG/SUPPORT-VECTOR-MACHINE/)

Previous Article
Big Data Developer - Hitachi - Hyderabad (http://www.analyticsvidhya.com/blog/2014/10/big-data-developer-hitachi-hyderabad/)

Next Article
Learning path & resources to start your data science (analytics) career today (http://www.analyticsvidhya.com/blog/2014/10/learning-path-resources-start-analytics/)

(http://www.analyticsvidhya.com/blog/author/tavish1/)

Author

Tavish Srivastava (http://www.analyticsvidhya.com/blog/author/tavish1/)

I am Tavish Srivastava, a post graduate from IIT Madras in Mechanical Engineering. I have more than two years of work experience in Analytics. My experience ranges from hands on analytics in a developing country like India to convince banking partners with analytical solution in matured market like US. For last two and a half years I have contributed to various sales strategies, marketing strategies and Recruitment strategies in both Insurance and Banking industry.

12 COMMENTS

Harshal says: REPLY (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=26472#RESPOND)
OCTOBER 3, 2014 AT 7:40 AM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-
SIMPLIFIED/#COMMENT-26472)

It is very useful for kaggle.
With "svm" package in R; data required in numerical only.
It is also useful for high dimensional data ; and also where dimensions are more than
observations.

Tavish says: REPLY (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=26682#RESPOND)
OCTOBER 4, 2014 AT 4:36 PM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-
SIMPLIFIED/#COMMENT-26682)

True that

Naveen Mathew says: REPLY (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=26485#RESPOND)
OCTOBER 3, 2014 AT 11:01 AM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-
SIMPLIFIED/#COMMENT-26485)

SVM is a very powerful classification tool. SVM + Cover's theorem combination has been
used many times. It all started with the XOR gate. It's wonderful to see the range of
problems it can solve.

Md. Siddikur Rahman says: REPLY (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=26520#RESPOND)
OCTOBER 3, 2014 AT 4:56 PM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-
SIMPLIFIED/#COMMENT-26520)

Give me some practical examples using R codes..

Tavish says: REPLY (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=26678#RESPOND)
OCTOBER 4, 2014 AT 4:35 PM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-
SIMPLIFIED/#COMMENT-26678)

Sidshikur,
We have a few articles in pipeline which will answer your query.
Tavish

Abhi says: REPLY (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=26623#RESPOND)
OCTOBER 4, 2014 AT 7:57 AM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/#COMMENT-26623)

Thank you for this awesome and easy explanation. SVM always sounded very scary before you explained it so well.

Tavish says: REPLY (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=26681#RESPOND)
OCTOBER 4, 2014 AT 4:36 PM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/#COMMENT-26681)

Stay tuned for more detailed articles on SVM

Tavish says: REPLY (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=26679#RESPOND)
OCTOBER 4, 2014 AT 4:35 PM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/#COMMENT-26679)

Stay tuned for more detailed articles on SVM

All you need to know to start a career in analytics (http://www.analyticsvidhya.com/blog/2014/12/start-career-analytics-industry/) says:

DECEMBER 7, 2014 AT 9:24 PM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/#COMMENT-48270)

[…] 7. http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/ (http://www.analyticsvidhya.com/blog/2014/10/support-vector-machine-simplified/) […]

KARTHI V says: REPLY (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=82462#RESPOND)
MARCH 24, 2015 AT 9:23 PM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/#COMMENT-82462)

Awesome explanation.Thank you

Saikiran says: REPLY(HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=90179#RESPOND)
JULY 10, 2015 AT 12:22 PM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/#COMMENT-90179)

Do we have the next series of articles on SVM? I couldnt find any articles on SVM after this?
Can you please help?

Akshata says: REPLY(HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/?REPLYTOCOM=92100#RESPOND)
AUGUST 7, 2015 AT 4:07 PM (HTTP://WWW.ANALYTICSVIDHYA.COM/BLOG/2014/10/SUPPORT-VECTOR-MACHINE-SIMPLIFIED/#COMMENT-92100)

Great post! Really served to simplify my understanding. I have a request – could you
please write a post about M5' algorithm as well?

LEAVE A REPLY

Connect with:

(http://www.analyticsvidhya.com/wp-login.php?
action=wordpress_social_authenticate&mode=login&provider=Facebook&redirect_to=http%3A%2F%2F
vector-machine-simplified%2F)

Your email address will not be published.

Comment

Name (required)

Email (required)

Website

☐ Notify me of follow-up comments by email.

☐ Notify me of new posts by email.

SUBMIT COMMENT

TOP USERS

| Rank	Name	Points
1	Nalin Pasricha (http://datahack.analyticsvidhya.com/user/profile/Nalin)	3478
2	SRK (http://datahack.analyticsvidhya.com/user/profile/SRK)	3364
3	Aayushmnit (http://datahack.analyticsvidhya.com/user/profile/aayushmnit)	3075

4		binga (http://datahack.analyticsvidhya.com/user/profile/binga)	2623
5		vikash (http://datahack.analyticsvidhya.com/user/profile/vikash)	2190

More Rankings (http://datahack.analyticsvidhya.com/users)
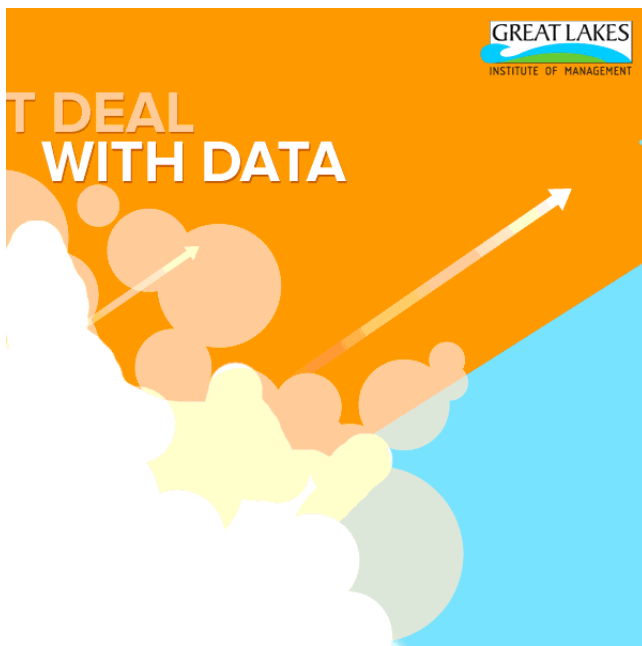
(http://pgpba.greatlakes.edu.in/?
utm_source=AVM&utm_medium=Banner&utm_campaign=Pgpba_decjan)

POPULAR POSTS

- Free Must Read Books on Statistics & Mathematics for Data Science
  (http://www.analyticsvidhya.com/blog/2016/02/free-read-books-statistics-mathematics-data-
  science/)
- A Complete Tutorial to Learn Data Science with Python from Scratch
  (http://www.analyticsvidhya.com/blog/2016/01/complete-tutorial-learn-data-science-python-
  scratch-2/)
- Essentials of Machine Learning Algorithms (with Python and R Codes)
  (http://www.analyticsvidhya.com/blog/2015/08/common-machine-learning-algorithms/)

- A Complete Tutorial on Time Series Modeling in R (http://www.analyticsvidhya.com/blog/2015/12/complete-tutorial-time-series-modeling/)
- Complete guide to create a Time Series Forecast (with Codes in Python) (http://www.analyticsvidhya.com/blog/2016/02/time-series-forecasting-codes-python/)
- 4 tricky SAS questions commonly asked in interview (http://www.analyticsvidhya.com/blog/2013/11/4-sas-tricky-analytics-interview/)
- SAS vs. R (vs. Python) – which tool should I learn? (http://www.analyticsvidhya.com/blog/2014/03/sas-vs-vs-python-tool-learn/)
- 7 Important Model Evaluation Error Metrics Everyone should know (http://www.analyticsvidhya.com/blog/2016/02/7-important-model-evaluation-error-metrics/)

SVM - Predictive Models

Support Vector Machine Predictive Models

○   ○

(http://imarticus.org/programs/business-analytics-professional/)

RECENT POSTS

(http://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-science-scratch/)

A Complete Tutorial to learn Data Science in R from Scratch (http://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-science-scratch/)

MANISH SARASWAT , FEBRUARY 28, 2016

(http://www.analyticsvidhya.com/blog/2016/02/guide-build-predictive-models-segmentation/)

Guide to Build Better Predictive Models using Segmentation (http://www.analyticsvidhya.com/blog/2016/02/guide-build-predictive-models-segmentation/)

GUEST BLOG , FEBRUARY 26, 2016

(http://www.analyticsvidhya.com/blog/2016/02/quick-insights-analytics-big-data-salary-report-2016/)

Quick Insights: India Analytics and Big Data Salary Report 2016 (http://www.analyticsvidhya.com/blog/2016/02/quick-insights-analytics-big-data-salary-report-2016/)

KUNAL JAIN , FEBRUARY 24, 2016

(http://www.analyticsvidhya.com/blog/2016/02/analytics-big-data-salary-report-2016/)

India Exclusive: Analytics and Big Data Salary Report 2016 (http://www.analyticsvidhya.com/blog/2016/02/analytics-big-data-salary-report-2016/)

KUNAL JAIN , FEBRUARY 22, 2016

(http://www.edvancer.in/certified-business-analytics?

utm_source=AV&utm_medium=AVads&utm_campaign=AVads1&utm_content=cbapavad)

GET CONNECTED

 4,162
FOLLOWERS
(http://www.twitter.com/analyticsvidhya)
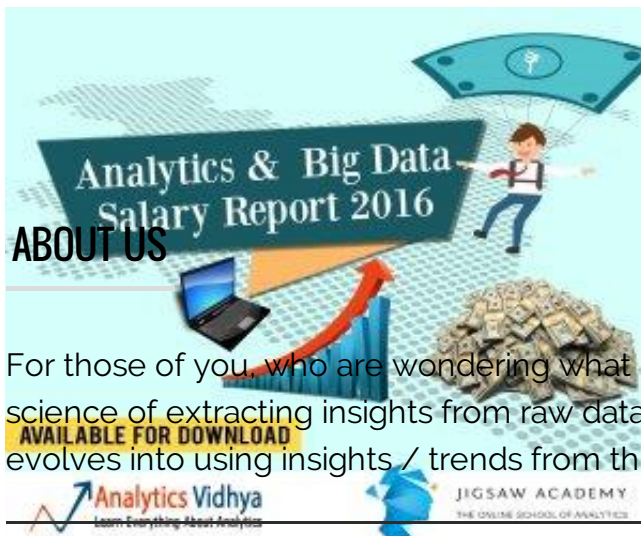
 11,954
FOLLOWERS
(http://www.facebook.com/Analyticsvidhya)

 915
FOLLOWERS
(https://plus.google.com/+Analyticsvidhya)

 Email
SUBSCRIBE
(http://feedburner.google.com/fb/a/mailverify?
uri=analyticsvidhya)

ABOUT US

 (http://www.analyticsvidhya.com/blog/2016/02/quick-

For those of you, who are wondering what is "Analytics Vidhya", "Analytics" can be defined as the science of extracting insights from raw data. The spectrum of analytics starts from capturing data and evolves into using insights / trends from this data to make informed decisions.

insights-analytics-big-data-salary-report-2016/)

STAY CONNECTED

𝕏 **4,162**
FOLLOWERS
(http://www.twitter.com/analyticsvidhya)

f **11,954**
FOLLOWERS
(http://www.facebook.com/Analyticsvidhya)

g+ **915**
FOLLOWERS
(https://plus.google.com/+Analyticsvidhya)

🔊 **Email**
SUBSCRIBE
(http://feedburner.google.com/fb/a/mailverify?
uri=analyticsvidhya)

LATEST POSTS

(http://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-
science-scratch/)

A Complete Tutorial to learn Data Science in R from Scratch (http://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-science-scratch/)

MANISH SARASWAT , FEBRUARY 28, 2016

(http://www.analyticsvidhya.com/blog/2016/02/guide-build-predictive-models-
segmentation/)

Guide to Build Better Predictive Models using Segmentation (http://www.analyticsvidhya.com/blog/2016/02/guide-build-predictive-models-segmentation/)

GUEST BLOG , FEBRUARY 26, 2016

(http://www.analyticsvidhya.com/blog/2016/02/quick-insights-analytics-big-data-
salary-report-2016/)

Quick Insights: India Analytics and Big Data Salary Report 2016 (http://www.analyticsvidhya.com/blog/2016/02/quick-insights-analytics-big-data-salary-report-2016/)

KUNAL JAIN , FEBRUARY 24, 2016

India Exclusive: Analytics and Big Data Salary Report 2016

(http://www.analyticsvidhya.com/blog/2016/02/analytics-big-data-salary-report-

2016/)

(http://www.analyticsvidhya.com/blog/2016/02/analytics-big-data-salary-report-2016/)
KUNAL JAIN , FEBRUARY 22, 2016

QUICK LINKS

Home (http://www.analyticsvidhya.com/)

About Us (http://www.analyticsvidhya.com/about-me/)

Our team (http://www.analyticsvidhya.com/about-me/team/)

Privacy Policy (http://www.analyticsvidhya.com/privacy-policy/)

Refund Policy (http://www.analyticsvidhya.com/refund-policy/)

Terms of Use (http://www.analyticsvidhya.com/terms/)

TOP REVIEWS

© Copyright 2015 Analytics Vidhya