

CLOUD ATLAS

Charting Our Course



Community Day and Training Workshops
October 5 – 8, 2020

LexisNexis® Risk Solutions will host the 7th annual HPCC Systems Community Day Virtual Summit on Monday October 5, 2020. New this year, we are offering post-event workshops on Tuesday October 6 through Thursday October 8 from 9am – 10am ET. The workshops will be split into three distinct one-hour virtual sessions, offered in both English and Portuguese.

Monday, October 5, 2020

Time (EDT)	Topic
9:00AM – 10:00AM	WELCOME AND PLENARY KEYNOTES
9:00AM – 9:10AM	- Welcome, Flavio Villanustre, VP Technology & CISO, LexisNexis Risk Solutions
9:10AM – 9:35AM	- HPCC Systems & the Cloud, Richard Chapman, VP Head of R&D, LexisNexis Risk Solutions
9:35AM – 10:00AM	- Data Lake Overview, Roger Dev, Sr Architect, LexisNexis Risk Solutions
10:00AM – 11:00AM	BREAKOUT SESSIONS (4 sessions running concurrently)
DATA LAKE	- Data Lake Deep Dive, Roger Dev, LexisNexis Risk Solutions
MACHINE LEARNING	- Optimal Lockdown Control for COVID-19, Yuting Fu, Researcher, Oxford University, UK
CLOUD	- Smart Learning & Market Insight in Hospitality, David Dasher, CTO, CPL Learning
PLATFORM EXTENSIONS	- NLP++ Plugin, David de Hilster, LexisNexis Risk Solutions
11:00AM – 12:00PM	BREAKOUT SESSIONS (4 sessions running concurrently)
DATA LAKE	- COVID-19 Data Lake, Arjuna Chala, Lili Xu, & Roger Dev, LexisNexis Risk Solutions
MACHINE LEARNING	- Managing Data Pipelines, Adwait Joshi, Chief Seer, DataSeers - Scaling Data Science & Analytics, Bill Franks, DataSeers Advisor, Chief Analytics Officer, IIA
CLOUD	- Leveraging and Evaluating Kubernetes Support on Microsoft Azure, Yash Mishra, Clemson University
PLATFORM EXTENSIONS	- Using the HPCC Systems Generalized Neural Network (GNN) Bundle with TensorFlow to Train a Model to Find Known Faces Leveraging the Robotics API - Distributed GPU Accelerated Neural Networks with GNN, Robert Kennedy, Florida Atlantic University
12:00PM – 1:00PM	INTERACTIVE EXPO BOOTH & POSTER DISPLAYS
	Poster Displays, demos and 1:1 interactive Q&A with our HPCC Systems experts
1:00PM – 2:00PM	BREAKOUT SESSIONS (4 sessions running concurrently)
DATA LAKE	- The Making of an Agriculture Data Lake, Dr Vincent Freeh, Kelly Zering and Gurman Singh, North Carolina State University
MACHINE LEARNING	- Athlete 360: Leveraging HPCC Systems for Player Performance and Return during COVID-19, Christopher Connelly, North Carolina State University
CLOUD	- Virtual CodeDay and the Big Data Challenge – Bringing Students Together to Raise Awareness and Talent in the Big Data Analytics Field, Tyler Menezes, Executive Director, CodeDay
PLATFORM EXTENSIONS	- A HAT Story - HPCC Analytics Tool, Apaar Sinha, LexisNexis Risk Solutions
2:00PM – 3:00PM	CLOSING PLENARY SESSIONS
2:00PM – 2:10PM	- Community Recognition & Poster Awards, Trish McCall & Lorraine Chapman
2:10PM – 2:30PM	- Machine Learning Advancements, Lili Xu & Roger Dev, LexisNexis Risk Solutions
2:30PM – 2:50PM	- 2021 Platform Vision, Gavin Halliday, LexisNexis Risk Solutions
2:50PM – 3:00PM	- Wrap-up & Adjourn, Flavio Villanustre, LexisNexis Risk Solutions

Remote ECL Training Workshops October 6 – 8, 2020

A three hour workshop, **Mastering the Relational, ROXIE and Regressive Realms with ECL**, is for Community Day attendees who want to expand their knowledge of the HPC Systems platform and ECL in three different phases. The workshop will take students through mastering relational queries, building an index in ROXIE using nested child datasets, writing a ROXIE service for data delivery, and wrapping up with an introduction to Machine Learning using a Learning Trees Regression Model. Code examples and lesson materials will be included.

Attendees can attend any one-hour session or the whole workshop. We will also offer this same workshop taught in Portuguese following the same format occurring on the same days and times.

Prerequisites: This workshop assumes that the attendee have a basic understanding of HPC Systems and ECL. We recommend that you complete our online Introduction to [ECL Courses \(Part 1 and 2\)](#) before attending.

Instructors: Bob Foreman, Senior Software Engineer, LexisNexis Risk Solutions
Hugo Watanuki, Senior Technical Support Engineer, LexisNexis Risk Solutions

Tuesday, October 6, 2020

Time (EDT)	Topic
9:00AM – 10:00AM	Phase 1 – The Relational Realm The first hour unleashes the power of ECL with Relational Datasets, and discusses the advantages of using them. <ul style="list-style-type: none">• Creating hierarchical relational datasets (Nested Child Datasets)• Nested Child Dataset Definitions (RECORD/DATASET)• NORMALIZE and DENORMALIZE• Complex Multi-level Relational Querying

Wednesday, October 7, 2020

Time (EDT)	Topic
9:00AM – 10:00AM	Phase 2 – The ROXIE Realm The second hour builds on what we started in Phase 1 and moves forward by delivering this data to ROXIE. We discuss and demonstrate the best practices of building indexed datasets and powerful data queries. <ul style="list-style-type: none">• Fundamentals of Data Delivery• Defining and Creating INDEXes• Using FETCH• Creating ROXIE Queries (STORED)• Deploying (Publishing) to ROXIE• Payload Indexes• Full and Half-Keyed JOIN

Thursday, October 8, 2020

Time (EDT)	Topic
9:00AM – 10:00AM	Phase 3 – The Regression Realm The final hour dives into a practical introduction to Machine Learning using ECL and Learning Trees bundle, and demonstrates how to build a Regressive (Quantitative) Model using a Property Price Predictor. <ul style="list-style-type: none">• Overview of Machine Learning• Qualitative (Regression) and Quantitative (Classification)• Overview of Learning Trees• Best Practices of Machine Learning• Learning Trees Tutorial

Session Descriptions

Monday, October 5, 2020

Time (EDT)	Topic
9:00AM – 10:00AM	WELCOME AND PLENARY KEYNOTES
9:00AM – 9:10AM	- Welcome, Flavio Villanustre, VP Technology & CISO, LexisNexis Risk Solutions Join Flavio Villanustre as we kick off the 7th annual HPCC Systems Community Day.
9:10AM – 9:35AM	- HPCC Systems & the Cloud, Richard Chapman, VP Head of R&D, LexisNexis Risk Solutions HPCC Systems and the cloud should be a natural fit – both involve large quantities of identical, commodity, interchangeable hardware, working together on a problem. This talk will describe the changes that we are making (or have made) to make cloud deployments of the HPCC Systems platform seamless.
9:35AM – 10:00AM	- Data Lake Overview, Roger Dev, Sr Architect, LexisNexis Risk Solutions Today, most organizations recognize that their data is a valuable resource. Yet, in most cases, they fail to realize much of the potential value hidden therein. The inherent value of data is mostly hidden from view -- Like an iceberg, the bulk of it is invisible to most observers. Even the most gifted have difficulty discerning where the nuggets of value are hidden among the data's bulk. This is not only for the apparent reasons of visibility and complexity. The bulk of the value of data remains hidden until it is activated by the presence of other synergistic data. Two datasets with little apparent utility can often be combined to form a unique value proposition, just as two invisible gasses (Hydrogen and Oxygen) can combine to create an unpredictable outcome – liquid water. This data alchemy can produce new insights, but can also enable completely new businesses or industries. This has happened time and time again. But when we try to apply traditional data processing techniques to unlock the value of data, we not only fail to glean the value expected, but we often inhibit the very process by which the value is discovered. Data Lake is an architecture and methodology for the continuous extraction of value from complex and diverse data resources, whether public or private. It has been successfully used by many organizations, and has spawned whole new lines of business. More important, it has enabled these businesses to continue to extract new value, even as earlier insights are put into production. This talk introduces Data Lake Concepts and Terminology for those who are new to the subject.
10:00AM – 11:00AM	BREAKOUT SESSIONS (4 sessions running concurrently)
DATA LAKE	- Data Lake Deep Dive, Roger Dev, LexisNexis Risk Solutions Continuing from the opening Data Lake Overview keynote, in this talk you will learn how the open source HPCC Systems Data Lake Management Platform empowers you to: <ul style="list-style-type: none"> • Quickly build a Data Lake repository that provides an evolutionary foundation for the extraction of data value • Explore your data and enrich it in an unbounded number of directions • Rapidly convert data discoveries and insights into hardened production applications • Support large teams of developers while minimizing bottlenecks • Economically scale to nearly unlimited data volumes and any size user base
MACHINE LEARNING	- Optimal Lockdown Control for COVID-19, Yuting Fu, Researcher, Oxford University, UK We will present our optimal lockdown control model for COVID-19, in which we extend the SIR epidemic model to include the effect of people's working and consumption on the spread of the pandemic, and control the lockdown rate to maximize the utility of the whole society, while people making decisions for their own benefits. Real-world data is used for parameter estimation in the simulation.
CLOUD	- Smart Learning & Market Insight in Hospitality, David Dasher, CTO, CPL Learning This talk will cover three projects all powered by HPCC Systems in the hospitality sector.

The first being Smart Learning from CPL Learning where we focus on a learners journey where they may be struggling with a topic or particular micro subject or a business feels the need to concentrate more on a particular subject like Upselling Beer or more

knowledge on Allery Awareness. Our platform takes everything we know about a learner and decides where to fill in the gaps or to enhance the learner's knowledge.

The second Project for our Parent Company CGA who is newly introduced to HPCC Systems to track Market data for Hospitality businesses in the US with a new product called RestaurantTrak. Taking feeds from EPOS data all over the US to provide Me versus the Market analysis to businesses from Bars to Polished Dining Restaurants.

Finally, in the GB market we look at a new suite of API's powered by HPCC Systems to help hospitality customers gain insight to life during COVID, taking nearly 5 billion data rows spanning over years to compare how current performance is compared to previous years and months. We can also see the impact of the UK government's EatOutToHelpOut Scheme. The volume and sheer amount of aggregations make this a huge challenge to deliver the data within 3 days of sale.

PLATFORM EXTENSIONS**- NLP++ Plugin, David de Hilster, LexisNexis Risk Solutions**

The newly open sourced NLP++ and VisualText technologies allows for powerful NLP for extraction of information from free text. The new NLP Plugin brings this processing power to ECL. NLP++ and VisualText architect and member of the HPCC Systems Architecture team, David de Hilster will talk about the advantages of NLP++ over other NLP systems including Machine Learning and why this powerful technology is uniquely suited to integrate with HPCC Systems.

11:00AM – 12:00PM**BREAKOUT SESSIONS (4 sessions running concurrently)****DATA LAKE****- COVID-19 Data Lake, Arjuna Chala, Lili Xu, & Roger Dev, LexisNexis Risk Solutions**

The Covid-19 Data Lake and the Covid-19 Tracker project illustrate the power of HPCC Systems Data Lake methodology to rapidly create and evolve a Data Lake to provide a deep insight into the evolution of the Covid-19 pandemic around the world. The creators of this project demonstrate the results, and discuss the process followed and lessons learned on this journey.

- Product Demo
- Development of metrics
- User interface architecture
- Data Lake Architecture and Data Flow
- Future directions

MACHINE LEARNING**- Managing Data Pipelines, Adwait Joshi, Chief Seer, DataSeers**

Data comes in various shapes, sizes and velocities. In the real world, certain things move fast (e.g. payments by consumers) while some others move slowly (interest calculations, updates to a customer address etc.). DataSeers is Taming This Data Demon, by managing various data pipelines. HPCC Systems is the heart of FinanSeer. It's responsible of pumping data back and forth through the entire application. If the heart stops the application breaks! In this session you will learn how to manage Data Pipelines using HPCC Systems.

- Scaling Data Science & Analytics, Bill Franks, DataSeers Advisor, Chief Analytics Officer, IIA

Building theoretically and methodologically powerful data science and analytics processes is not enough. In order to succeed, it is more necessary than ever that data science processes are also able to scale to an enterprise level. Achieving the required scale involves a mix of technologies, processes, and methodological approaches that take advantage of the latest offerings available in the marketplace today. Tradeoffs are often necessary, such as deploying a slightly less powerful methodology that will fully scale as opposed to pursuing more robust methodologies that will not scale. This talk will discuss some of the trends helping organizations to successfully deploy highly scalable data science processes today.

CLOUD**- Leveraging and Evaluating Kubernetes Support on Microsoft Azure, Yash Mishra, Clemson University**

Deployment of HPCC Systems to commercial clouds can be done in multiple ways depending on various business needs. One way to go is a Lift-and-Shift, which involves moving of unchanged application infrastructure from on-prem to the cloud based on

virtual machine approach. On the other hand, containerization of the application with the aim to go cloud-native is another approach. The recent push of HPC Systems to go cloud-native involves containerization strategy. This provides a logical packaging mechanism in which HPC Systems resources are abstracted from the environment in which they run. This abstraction of resources into containers allows multiple containers running on top of the OS kernel directly.

This project leverages the new Kubernetes version of HPC Systems for the cloud by targeting Microsoft Azure. To understand how HPC Systems runs on the cloud-native platform, this project examines the following aspects:

- Provisioning and deploying containerized HPC Systems on Azure via Azure Kubernetes Service
- Cluster lifecycle under Kubernetes
- Architectural differences between Kubernetes and legacy environment
- Storage consideration and orchestration in Kubernetes environment
- Cloud cost considerations
- Challenges under the Kubernetes environment

References:

[1] Setting up a Default HPC Systems Cluster on Microsoft Azure Cloud Using HPC Systems 7.8.x and Kubernetes, Jake Smith | HPC Systems. <https://hpcsystems.com/blog/default-azure-setup>.

[2] Persisting Data in an HPC Systems Cloud Native Environment, Gavin Halliday | HPC Systems. <https://hpcsystems.com/blog/persisting-data-cloud>.

PLATFORM EXTENSIONS

- **Using the HPC Systems Generalized Neural Network (GNN) Bundle with TensorFlow to Train a Model to Find Known Faces Leveraging the Robotics API, Tai Donovan & Jack Fields, American Heritage School**

With the rise in need of school security we hope to develop a robot that can combat this problem. This autonomous security robot at American Heritage will allow the school to recognize known faces, use the RFID scanner to collect information, recognize license plates, and store and locate the data gathered from the RFID scanner and other systems. The security robot will have a customized introductory greeting, name recognition, and schedule locator. A mounting system was designed for the cameras that can be repositioned and adjusted to best capture the license plate. The drivetrain is composed of two sets of six pneumatic wheels. Each set of wheels is powered by a custom built, dual motor, single speed gearbox. The gearboxes use a gear ratio of 21.21:1, allowing the robot to reach a top speed of roughly 7.57 feet per second. We have furthered our HPC SYSTEMS integration by using the HPC Systems GNN bundle with Tensorflow. We have been able to gather a database with students and train a model to recognize known faces. We have also upgraded our ROBOT API to work with the newest versions of ROS.

RFID Scanner

The RFID scanner will gather information by scanning teachers, students, parents, and any guests ID. The information will be stored and the security robot can locate the information when it is needed by the security team on campus.

Virtual Reality

A virtual reality environment is being developed to monitor the cameras and robot information. This will implement basic displays from USB cameras and image files. We are working on building a user-friendly environment with multiple video and informational displays.

- **Distributed GPU Accelerated Neural Networks with GNN, Robert Kennedy, Florida Atlantic University**

The HPCC Systems Platform leverages many commodity computers to perform high performance computing tasks. The underlying hardware traditionally only provides a CPU for the actual computations and communicate with other member computers via networking protocols. This approach has proven to be very effective for many demanding applications. However, training large neural networks—or Deep Learning—is best benefited by utilizing hardware acceleration for the bulk of the computationally expensive tasks. In this talk, I will present the results of work that expands HPCC Systems and its General Neural Network (GNN) bundle by leveraging multiple GPUs that span across a cluster. Using hardware acceleration with the GNN bundle allows the ECL machine learning developer to drastically reduce training time. Further, this work is not limited to one GPU nor one physical computer. This work demonstrates that it is now possible to spread GNN computations over multiple GPUs either multiple GPUs in one machine or across multiple GPUs across multiple machines.

12:00PM – 1:00PM

INTERACTIVE EXPO BOOTH & POSTER DISPLAYS

Poster Displays, demos and 1:1 interactive Q&A with our HPCC Systems experts

1:00PM – 2:00PM

BREAKOUT SESSIONS (4 sessions running concurrently)

DATA LAKE

- The Making of an Agriculture Data Lake, Dr Vincent Freeh, Kelly Zering and Gurman Singh, North Carolina State University

Farm and crop data is abundant. It comes from machinery, satellite and drone images, commodities exchanges, and more. Proper decisions depend on in-depth understanding and analysis of the available data. Furthermore, the data come from many diverse sources. Consequently, farmers and farm managers are overwhelmed and ill equipped to exploit the information. In this presentation we will discuss how we created a data lake for agriculture data. There are several streams feeding the lake with raw data, such as USDA data and mercantile exchange pricing data. The raw data from the streams is assembled and organized to create derived information from the raw data, such as production rates. Additional knowledge is created using predictive analytics and machine learning. Finally, all this data, information, and knowledge can be viewed in a custom web application and is used in a custom proprietary decision-support application in which farmers can evaluate the profit of various crop planting scenarios in order to better manage their farms.

This project is installed on an HPCC Systems server. Data from the streams are fetched daily and incorporated into the lake. Custom ECL code processes new and old data to update information and knowledge. A custom web application presents this information in charts and tables. The data-viewing and decision-support applications retrieve information from the data lake using the REST interface in WsECL. This project exercises the breadth and depth of HPCC Systems.

We will present an overview of the project and live demonstrations of both the data-viewing and decision-support applications.

MACHINE LEARNING

- Athlete 360: Leveraging HPCC Systems for Player Performance and Return during COVID-19, Christopher Connelly, North Carolina State University

The ultimate goal in all sports is to win. The athletes that participate must be ready to perform at their best when needed, which for most is their entire season. This requires everyone involved, from coaches, to athletes, the medical team, and performance staff to all work together and strive for peak athlete performance. Within team sports, there are a lot of external variables that can't be controlled for, so any help that can be used to aid the process of training athletes can be very impactful. This is where sport science exists, growing at a rapid rate. The more sources of different data we can bring in about athletes and how they respond to training, the better ability we have to understand the stresses on their body and what can be done to help them be at their best. In collegiate athletics, there is no real established means by which different data sources can be brought together to aid in the interpretation and reporting of that data for coaches. This is where HPCC Systems plays a role. In this talk, learn how NC State University Strength & Conditioning is addressing this challenge by using HPCC Systems for collecting and analyzing all the various data streams from questionnaires, training

loads from practice and weight room sessions, as well as testing for strength, speed, and fitness, to create a 360 view of athlete wellbeing to ensure they are performing at their highest potential. Also, during times of a pandemic, see a glimpse of how data is being used to help make decisions around athlete's returning to play during COVID-19. Regaining fitness and strength, and rebuilding resilience to keep athletes healthy and ready to perform at a high level once again.

CLOUD	<p>- Virtual CodeDay and the Big Data Challenge – Bringing Students Together to Raise Awareness and Talent in the Big Data Analytics Field, Tyler Menezes, Executive Director, CodeDay</p> <p>At a time when events have been cancelling and schools have been moving online, the CodeDay team took their events online and created more opportunities for our younger generation of students to learn what Big Data Analytics is all about. In this talk, hear from Executive Director and creator of CodeDay, Tyler Menezes, on how he partnered with LexisNexis Risk Solutions to give students a platform to work on real life big data challenges leveraging HPCC Systems. Thousands of students have taken part in this event, creating an amazing experience for the students to help boost their skills and interest in this field.</p>
PLATFORM EXTENSIONS	<p>- A HAT Story - HPCC Analytics Tool, Apaar Sinha, LexisNexis Risk Solutions</p> <p>The presentation will include a demo of the HPCC Analytics Tool (HAT). HAT is a web application built in the .Net framework and has the capability to run metrics on a single work unit and compare two work units. The former includes high level KPIs, graph and subgraph timers, input/output information, and spill/sort analysis. The latter not only compares all these metrics, but also compares the graph structure by determining the node and edge similarity scores. This talk will be helpful for both experts and beginner level ECL developers who are looking for ways to get insights on their WU performance and answer questions like why did a WU run considerably slower than usual or how much time did the WU spend in handling spills or input/output operations. Prior knowledge on ECL will be helpful.</p>
2:00PM – 3:00PM CLOSING PLENARY SESSIONS	
2:00PM – 2:10PM	<p>- Community Recognition & Poster Awards, Trish McCall & Lorraine Chapman</p> <p>Join us as we announce the recipients of the 2020 HPCC Systems Community Recognition and David Kan Ambassador Awards. Winners of the 2020 Poster Competition will also be unveiled.</p>
2:10PM – 2:30PM	<p>- Machine Learning Advancements, Lili Xu & Roger Dev, LexisNexis Risk Solutions</p> <p>The HPCC Systems Machine Learning Library continues to evolve and provide richer capabilities. This talk focuses on two major areas of new development:</p> <ul style="list-style-type: none"> • Enhanced Methods for Data Preparation • Generalized Neural Networks Version 2.0: <ul style="list-style-type: none"> o Overview of modern Neural Networks o Multiple Model Support o Complex Model Support via Keras Functional API o Tensorflow 2.0 Support
2:30PM – 2:50PM	<p>- 2021 Platform Vision, Gavin Halliday, LexisNexis Risk Solutions</p> <p>Join Gavin as he shares what the core HPCC Systems team has in store for current plans and the year ahead on the platform.</p>
2:50PM – 3:00PM	<p>- Wrap-up & Adjourn, Flavio Villanustre, LexisNexis Risk Solutions</p> <p>Flavio closes the exciting day with a wrap-up and thank you to our Community.</p>

Interactive Expo Booths

Booth Name	Description
Meet the ML Team	Get all the information you need to know on our Machine Learning libraries and algorithms
HPCC Systems Community Contribution Corner	New to HPCC Systems? Want to find ways to contribute to the HPCC Systems community? Interested in speaking at an upcoming Tech Talk or podcast? We want to hear from you!
Tooling Around	The HPCC Systems Solutions Lab is working on innovative tools and extensions to the HPCC Systems platform. Pop by and check out the ECL Cloud IDE, RealBI, Tombolo, Medley and DataPatterns.
Academic Chat & Share	Looking to intern with us in 2021? Need to know more information on how to become an academic collaborator? Come chat with us!
ECL Training Chat and Resources	Have a question for our instructors? Need help with a lesson in the workshop(s)? The trainers are here to help!
Come to the Cloud	Ask our Cloud Journey experts questions on how HPCC Systems is moving to the Cloud
Platform Q&A	Have questions about the HPCC Systems Platform? Come ask our experts!

Poster Display Booths

Presenter	Affiliation	Topic
Ambu Karthik	R.V. College of Engineering, India	Implementation of Generative Adversarial Networks in HPCC Systems using GNN Bundle
Nathan Halliday	Hills Road Sixth Form College, Cambridge, UK	The Parallel Workflow Engine
Gurman Singh	North Carolina State University, USA	The Making of an Agricultural Data Lake
Lucas Varella	Federal University of Santa Catarina, Brazil	A Cross provider assessment for HPCC Systems container orchestration
Vannel Zeufack	Kennesaw State University, USA	Preprocessing Bundle for HPCC Systems Machine Learning Library
Jeff Mao	Lambert High School, USA	HPCC Systems on Google Anthos
Robert Kennedy	Florida Atlantic University, USA	Distributed GPU Accelerated Neural Networks with GNN
Jack Fields	American Heritage School, USA	Using the HPCC Systems Generalized Neural Network (GNN) Bundle with TensorFlow to Train a Model to Find Known Faces Leveraging the Robotics API
Matthias Murray	New College of Florida, USA	Applying HPCC Systems Text Vectors to SEC Filings
Yash Mishra	Clemson University, USA	Leveraging and Evaluating Kubernetes support on Microsoft Azure
Johny Chen Jy	Federal University of Santa Catarina, Brazil	Deltabase caching solutions: an exploratory analysis for increasing ROXIE queries' performance
Atreya Bain	R.V. College of Engineering, India	HSQL: A SQL-like language for HPCC Systems
Varsha R Jenni	R.V. College of Engineering, India	Hybrid Density-based Adaptive clustering using Gaussian kernel and Grid Search