



LEARNING, APPLYING, MULTIPLYING BIG DATA ANALYTICS

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## **LAMBDA Deliverable 3.6**

### **Belgrade BDA School (Report 2)**

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Dissemination Level		
PU	Public	x
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	



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0.3	29.06.2019	Valentina Janev	Documenting the event
0.4	30.06.2019	Dea Pujić (PUPIN)	Internal review
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Institute for Computer Science - University of Bonn ( <b>UBO</b> )	Contractor	Germany
Department of Computer Science - University of Oxford ( <b>UOXF</b> )	Contractor	UK

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## Executive Summary

The 2<sup>nd</sup> edition of LAMBDA Big Data Analytics Summer School was organized by the LAMBDA consortium partners Institute Mihajlo Pupin (PUPIN), Fraunhofer Institute for Intelligent Analysis and Information Systems (Fraunhofer/IAIS), Institute for Computer Science - University of Bonn (UBO) and Department of Computer Science - University of Oxford (UOXF) on June 16th and June 17th, 2020. Because of the COVID-19, the event took place online. Overall, more than 70 participants joined the online sessions. The objective of the summer school was to give the PhD students and professionals from Serbia and abroad an opportunity to learn about the newest technologies and trends in this and related fields from invited distinguished speakers and from lecturers from the LAMBDA consortium.

The topics of the keynotes and the lectures extended the topics introduced in 2020 ([Enterprise Knowledge Graphs](#), [Semantic Big Data Architectures](#), [Smart Data Analytics](#)) and included also [Foundations](#), [Artificial intelligence](#), [Big Data Tools](#) and [Case Studies](#).

The website of the summer school, <https://project-lambda.org/BDA-Summer-School-2020>, provides more details about the organization and topics discussed at the school.



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## Abbreviations and Acronyms

<b>BDA</b>	Big Data Analytics
<b>NoE</b>	Network of experts
<b>OERs</b>	Open Educational Resources
<b>WP</b>	Work Package

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# 1. Introduction

The overall objectives of the LAMBDA (Learning, Applying, Multiplying Big Data Analytics, <http://www.project-lambda.org/>) project are to

- stimulate scientific excellence and innovation capacity, as well as to increase the research capacities and unlock the research potential of the “Mihajlo Pupin” institute (PUPIN),
- contribute to decreasing the existing European regional research and innovation disparity by fostering excellence in the Big Data ecosystem areas,
- contribute to European progress beyond the state of the art of related research and technology.

One of the major annual teaching, knowledge transfer and dissemination events is the Big Data Analytics Summer School that was organized online on 16<sup>th</sup> and 17<sup>th</sup> of June 2020. Participants of the School were researchers from the Institute Mihajlo Pupin, as well as invited researchers / professors / PhD students and other professionals (see Figure 1, Table 5 and Table 6) from Serbia and abroad.

This year, the School was also promoted in India, via the established collaboration with the Indian Institute of Technology (IIT) Jodhpur, Rajasthan, India.

The Web site of the Summer School is <https://project-lambda.org/BDA-Summer-School-2020>.

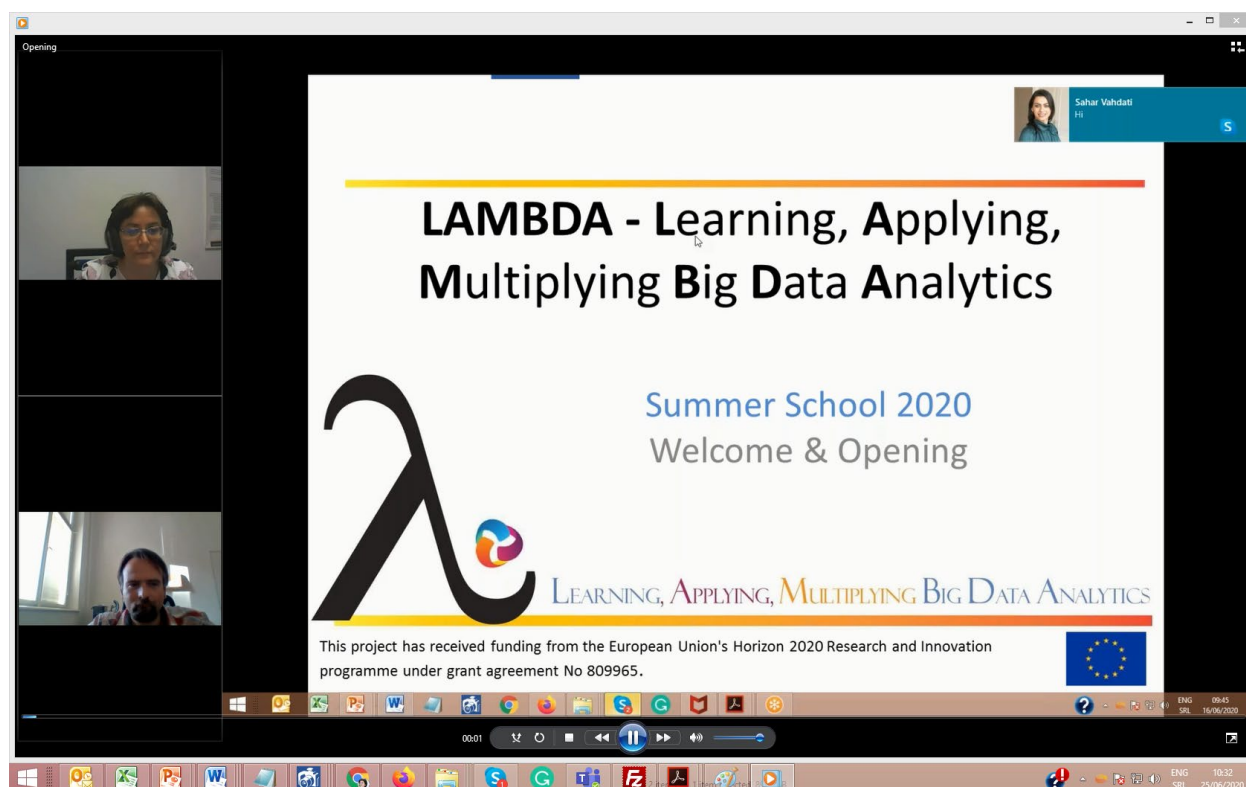


Figure 1. BDA School 2020 - Screenshot from the Opening session

## 1.1 Relation to Other Deliverables

This Deliverable is related to



1. [Deliverable 3.1 The 'Trainers' Network' Infrastructure](#)<sup>1</sup> that describes the 'Train-the-Trainers' approach adopted by LAMBDA.
2. [Deliverable 3.2 Enterprise Knowledge Graphs](#)<sup>2</sup> that summarizes the lectures from the 1<sup>st</sup> Big Data Analytics Summer School.
3. [Deliverable 3.3 Semantic Big Data Architecture](#)<sup>3</sup> that points to the lectures related to architectures.
4. [Deliverable 3.4 Smart Data Analytics](#)<sup>4</sup> that describes the complete set of lectures developed by June 2020.
5. [Deliverable 3.5 Belgrade BDA School \(Report 1\)](#)<sup>5</sup> that summarizes the organization of the 1<sup>st</sup> BDA School.

## 1.2 Target Audience

The following table defines the intended audience of the current deliverable:

Intended audience	Reasons for interest in this document
<b>Consortium partners</b>	To summarize the conducted activities and use as a basis for the preparing the next year Summer School
<b>Participants / Stakeholders</b>	To have on one place the information about the event with links to all relevant support documents (open resource lectures and PPT presentations from the Advisory Board Members, links to the private side of the portal), and evidence (pictures, Agenda, Information Pack)
<b>European Commission</b>	To review and assess this deliverable as a required report based on the grant agreement
<b>General public</b>	To be informed about the LAMBDA activities

Table 1. Target audience for this deliverable

## 1.3 Structure of the Deliverable

This Deliverable is the sixth document delivered in WP3 framework and presents the following points:

- The Program of the LAMBDA Summers School 2020 (Section 2);
- Statistics (Section 3);
- potential impact and adoption of LAMBDA lectures by PUPIN researchers and researchers from the region (Section 4);
- communication within the BDA School Participants Group (Section 5).

<sup>1</sup> <https://project-lambda.org/D3.1>

<sup>2</sup> <https://project-lambda.org/D3.2>

<sup>3</sup> <https://project-lambda.org/D3.3>

<sup>4</sup> <https://project-lambda.org/D3.4>

<sup>5</sup> <https://project-lambda.org/D3.5>



## 2. Summer School Program and Key Activities

### 3.1 Overview of the Program

The Program of the School was decided by the core LAMBDA Team including the following members:

- Valentina Janev, Sanja Vraneš (PUPIN)
- Diego Collarana Vargas, Damien Graux (IAIS)
- Hajira Jabeen, Jens Lehmann (UBO)
- Emanuel Sallinger, Sahar Vahdati (UOXF)

The Program of the School was aligned with the needs of PUPIN researchers. In order to include lectures related to other LAMBDA activities such as development prototypes and foresight activities, keynote speakers and experts were invited to be part of the Program.

The Program of the School was divided into 6 Sessions named

- Keynotes (Opening Session)
- EU Perspective and Foresight
- Foresight panel on BigData
- Knowledge Graphs
- Knowledge Graphs and AI
- Big Data Applications (Closing Session)

as is presented in Table 2.

	Day 1	Day 2
09:00	Establishing connections (see instructions below)	
09:45	<b>Opening</b> <b>Using Big Heterogeneous Health Data for Personalized Medicine</b> <b>Q &amp; A Session</b> <b>Semantic information infrastructures from business information delivery to water management (Keynote)</b> <b>Soft computing for Transparent synthesis of Geo Big Data (Keynote)</b> <b>Q &amp; A Session</b>	<b>Knowledge Graphs Creation</b> <b>Scalable KG Processing (SANSA)</b> <b>Q &amp; A Session</b> <b>Federated Query Processing</b> <b>Q &amp; A Session</b>
12:30	<b>Lunch Break</b>	
13:00	<b>Data for AI: The EC's Horizon Europe/Digital Europe Programs and BDVA's standpoint</b> <b>Reasoning on Financial Knowledge Graphs: The Case of Company Networks</b> <b>Chronorobotics: Spatio-temporal models for social and service robots</b> <b>Q &amp; A Session</b>	<b>Plenary Talk: AI and Knowledge Graphs</b> <b>Knowledge Graph Embeddings</b> <b>Context-Based Entity Matching for Big Data</b> <b>Q &amp; A Session</b>
16:00	<b>Panel – Big Data Foresight</b> <b>Closing</b>	<b>Big Data Applications</b>

Table 2. Program of the School – Day 1 and Day 2





### 3.2 Links to Video Lectures and other Teaching Materials

The easiest way to retrieve the materials from the 2<sup>nd</sup> Big Data Analytics Summer School is to use the Search functionalities of the LAMBDA Platform under this link <https://project-lambda.org/Knowledge-repository/Lectures>

The user has two options:

- Search by topic
- Search by event (select BDA School 2020), as is presented in Figure 2.

The screenshot shows the LAMBDA platform interface. At the top left is the LAMBDA logo with the tagline "LEARNING, APPLYING, MULTIPLYING BIG DATA ANALYTICS". To the right are navigation links: Home, Project, Summer School, eLearning, Private Section, Stakeholders Section, and Knowledge. Below the logo is a search bar with "Home" entered. On the right side, there are links for "My account" and "Log out", and a "Tools" section with a link for "Add content".

The main content area features two dropdown menus: "Select MODULE" (set to "- Any -") and "Select Event" (set to "- Any -"). Below these is an "Apply" button. A table displays the results for the selected event, "BDA School 2020".

Module		Presented at event	Contributed by	Available as
Artificial intelligence	Data for AI: Foresight	BDA School 2020	Fraunhofer	Video, PPT
Case Studies	Semantic information infrastructures from business information delivery to water management	BDA School 2020		Video

Figure 2. BDA School 2020 - Lectures

Video lectures has been uploaded to the LAMBDA YouTube Chanel, <https://www.youtube.com/channel/UC9BCAGX1dzCI2akuRxILq6Q/> and are embedded in pages on the LAMBDA platform, see Figure 3.

### 3.3 Other Teaching Material

The LAMBDA consortium prepared a book that includes the lectures presented by the LAMBDA researchers at the 1<sup>st</sup> and the 2<sup>nd</sup> BDA School. The table of contents is presented on Figure 4.



[View](#) [Edit](#) [Delete](#) [Revisions](#)

Posted on: Wed, 04/01/2020 - 21:11 By: [valentina.janev](#)

The goal of this chapter is to shed light on different types of big data applications needed in various industries including healthcare, transportation, energy, banking and insurance, digital media and e-commerce, environment, safety and security, telecommunications, and manufacturing. In response to the problems of analyzing large-scale data, different tools, techniques, and technologies have been developed and are available for experimentation. In our analysis, we focused on literature (review articles) accessible via the Elsevier ScienceDirect service and the Springer Link service from more recent years, mainly from the last two decades. For the selected industries, this lecture also discusses challenges that can be addressed and overcome using the semantic processing approaches and knowledge reasoning approaches discussed in this book.

The Lecture has been presented at the Big Data Analytics Summer School 2020 by [Dr. Valentina Janev](#), Institute Mihajlo Pupin, LAMBDA project coordinator.

• [My account](#)  
• [Log out](#)

## Tools

• [Add content](#)

The screenshot shows a video player interface. On the left is a small video feed of a woman speaking. The main area displays a presentation slide titled 'Big Data Ecosystem'. The slide content includes a definition of 'Ecosystem' and a list of bullet points about data storage and processing challenges.

**BDA Summer School 2020: Survey of Big Data Applications**

### Big Data Ecosystem

- The term **Ecosystem** is defined in scientific literature as a complex network or interconnected systems.
- While in the past corporations used to deal with static, centrally stored data collected from various sources, with the birth of cloud services, cloud computing is rapidly overtaking the traditional in-house system as a reliable, scalable and cost-effective IT solution.
- Thus, large datasets – log files, social media sentiments, click-streams – are no longer expected to reside within a central server or within a fixed place in the cloud.
- To handle the copious amounts of data, **advanced analytical tools are needed which can process and store**

Figure 3. Example of Video Lecture



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*Figure 4. LAMBDA Book – Table of Contents*



### 3.3 Questions and Answering (Q&A) Session

Six questions and answering sessions were organized and moderated by PUPIN staff where PUPIN researchers and other participants had an opportunity to ask questions and communicate with keynote speakers and other lecturers, see Table 3.

Feedback was collected by participants via the GoToMeeting Chat and the PUPIN mailing server, see Table 4.

*Table 3. Example Questions from Participants*

No #	Question
1	A question for Mariana: When you were using geospatial data to recognize water bodies, did you use automatic extraction or manual? Also did you use historical geospatial data?
2	A question for Gloria: did you have any chances to use fuzzy ontologies in reasoning/logic inference tasks? What is your feeling on the performance/complexity challenges posed by these models (e.g., in the GEO domain)? Thanks!
3	A question for Gloria: you showed an explainable AI method. how do you evaluate it?
4	In PUPIN, we have been dealing with the development of renewable energy production forecasts. Have you been thinking of expanding your software using geo-special data to provide production forecast prediction of PVs/WTs etc?
5	A question for Mariana: Could your system be used for management of some other industrial process (power, gas, waste water, ...)?
6	A question for Simon: Would you say that the Big Data space in terms of tools is too fragmented (and how the related issues that stem from this are resolved) or would you say that the most prominent solutions that are most widely used have been identified by now?
7	Question - Luigi - do you materialize the knowledge graphs ?
8	Question for Luigi, in your applications of knowledge graphs did you even encountered the need to represent and reason with uncertain and imprecise information? And if yes did you consider frameworks for uncertainty reasoning?
9	A question for Simon: Can you tell us are there any ongoing activities about cyber security standardization regarding data sharing space?
10	Is data processing complexity an issue with robotic systems that have to be mobile?
11	For Tom: What do you think the role of reasoning in knowledge graphs could/does play in your covid setting?



Table 4. Impressions from the BDA School 2020

Organization / Sector	Feedback collected
PUPIN student	Thanks Prof. Georgios for presenting this amazing project!
Advisory Board Member	Well done!
Student	I have attended the summer school during the two days it held. For employment purposes, I need a letter of verification of attendance. Would you see possible to provide such?
Student	Hvala puno, super ste ovo organizirali.
Potential adopter of Lectures	Hvala jos jednom na svemu. Naravno, samo citam.

### 3. Statistics about Speakers and Participants

Speakers at the BDA School 2020

Country	Name
Greece	Georgios Paliouras, NCSR "Demokritos" (Keynote)
Bulgaria	Mariana Damova, Mozaika (Keynote)
Italy	Gloria Bordogna, Italian National Research Council IREA (Keynote)
	Luigi Bellomarini, Banca d'Italia and University of Oxford
Germany	Maria Esther Vidal, German National Library for Science and Technology
	Simon Scerri, Fraunhofer IAIS
	Hajira Jabeen, University of Bonn
	Diego Collarana, Fraunhofer IAIS
Belgium	Anastasia Dimou, Ghent University
Ireland	Damien Graux, Trinity College Dublin
UK	Emanuel Sallinger, University of Oxford, Sahar Vahdati, University of Oxford
Serbia	Valentina Janev, Institute Mihajlo Pupin
	Nikola Tomašević, University of Belgrade
Czech Republic	Tom Krajník, Czech Technical University
India	Debasis Das, Indian Institute of Technology
Croatia	Neven Vrček, University of Zagreb
Bosnia and Herzegovina	Vedad Pašić, Univerzitet u Tuzli
North Macedonia	Dimitar Trajanov, Ss. Cyril and Methodius University
Montenegro	Luka Filipović, Univerzitet Crne Gore

Table 5. Speakers at the BDA School 2020

Teachers and Participants			
Country	Number	Country	Number
Serbia	35	India	1
Italy	7	Greece	1
Germany	7	Bulgaria	1



<b>UK</b>	4	<b>Romania</b>	1
<b>Czech Republic</b>	2	<b>North Macedonia</b>	1
<b>Belgium</b>	2	<b>Montenegro</b>	1
<b>Austria</b>	2	<b>Albania</b>	1
<b>Croatia</b>	2	<b>Ireland</b>	1
<b>Bosnia and Herzegovina</b>	2		
<b>Total</b>	<b>71</b>		

*Table 6. Statistics on Teachers and Participants by country*



## 4. Potential for Adoption of LAMBDA Lectures

The Table below gives the Faculties/Universities that expressed their interest in adopting the LAMBDA outputs. The Feedback questionnaire<sup>6</sup> (see also Figure 5) was distributed to participants of the School.

*Table 7. Potential adoption of LAMBDA teaching materials at universities in Serbia and the Region*

Faculty / University	Country
School of Electrical Engineering - University of Belgrade	Serbia
Faculty of Agriculture, The University of Novi Sad	Serbia
Faculty of Sciences, The University of Novi Sad	Serbia
Faculty of Electronic Engineering, The University of Niš	Serbia
Faculty of Mechanical Engineering – University of Niš	Serbia
Faculty of Transport and Traffic Engineering - University of Belgrade	
School of Engineering Management , Union Nikola Tesla University	Serbia
Faculty of Organization and Informatics , The University of Zagreb	Croatia
Faculty of Computer Science & Engineering, The Ss. Cyril and Methodius University	North Macedonia
Faculty of Electrical Engineering, The University of Montenegro	Montenegro
Faculty of Natural Sciences and Mathematics , The University of Tuzla	Bosna and Herzegovina
Faculty for Information Technologies, Belgrade Metropolitan University	Serbia

<sup>6</sup> <https://project-lambda.org/BDA-2019-Feedback>



## 2nd Summer School – Feedback Form

Organization / Country

\_\_\_\_\_

Organization Type (R&D Organization / Education / SME / Large-profit oriented / NGO)

\_\_\_\_\_

Please, mention possibilities for re-use of LAMBDA Lectures and responsible person

- Courses related to Data Analytics, AI, Big Data Architecture, Semantic Technologies, Big Data Analytics, Visualisation

\_\_\_\_\_

\_\_\_\_\_

- Projects related to Data Analytics, AI, Big Data Architecture, Semantic Technologies, Big Data Analytics, Visualisation

\_\_\_\_\_

\_\_\_\_\_

Please, mention other activities related to Big Data / Communities / Partnerships

\_\_\_\_\_

\_\_\_\_\_

Thank you very much for your time and attention.



This project has received funding from the European Union's Horizon 2020 Research and Innovation programme, H2020-WIDESPREAD-2016-2017 Spreading Excellence and Widening Participation under grant agreement No 809965.

Figure 5. Feedback Form about potential adoption of LAMBDA lectures





## 5. Communication within the BDA-School Participants Group

### 5.1 Preparatory Activities

Preparation of LAMBDA lectures is an activity that goes on continuously, from the very beginning of the project. The preparation of BDA School 2020 started at the end of 2019. The date was fixed in the beginning of year 2020, while the Program was discussed at the Plenary Meeting in Oxford, February, 2020.

Originally, it was planned to be a live event at the Mihajlo Pupin Institute's premises. However, due to COVID-19, the decision was made to hold an online 2-day event, while the 3<sup>rd</sup> day activities (hands-on sessions) were postponed for few months.

---

#### Session 2: February 11, 10.30-13.00 (PUPIN)

	Topic	Speaker
10:30	WP1 - Management - Discussion	Valentina
11:00	WP3 - BDA School - Discussion	All
11:30	WP4 - Staff exchange & Cooperation Discussion	Simon
12:00	WP6 - Discussion, Task 6.1 (Foresight Discussion)	Sahar
12.30	WP6 - Discussion, Task 6.2 (Sustainability & Long - Term Strategy)	Valentina

*Figure 6. Plenary Meeting, February 2020*

SANSA Hands-on Session has been elaborated as follows

- 45 minutes Introduction to Apache Spark
- 45 minutes Introduction to SANSA
- Hands-on in Traffic domain, data from Pupin
- Hands-on in Energy domain, data from Pupin

Due to the COVID-19, the Hands-on Session has been postponed and will take time in September 2020.

### 5.2 The BDA-School mailing List

The [bda-school@mail.project-lambda.org](mailto:bda-school@mail.project-lambda.org) is one of the channels for informing the potential stakeholders about the activities of the LAMBDA team, see Figure 7.



**Subject:** LAMBDA Big Data Analytics Summer School 2020, June 16-17, 2020 ONLINE  
**From:** "Valentina Janev" <valentina.janev@institutepupin.com>  
**Date:** Thu, April 23, 2020 9:53 am  
**To:** bda-school@mail.project-lambda.org ([more](#))  
**Bcc:** atanas.kiryakov@ontotext.com ([more](#))  
**Priority:** Normal  
**Options:** [View Full Header](#) | [View Printable Version](#) | [Download this as a file](#)

Dear Colleagues,

The LAMBDA Consortium cordially invites you to attend the "Big Data Analytics Summer School 2020" which will be held ONLINE on June 16-17, 2020, please check <https://project-lambda.org/BDA-Summer-School-2020>.

The event will bring together researchers and professionals from respectable EU Universities and companies and stakeholders from the West Balkan countries to discuss state-of-the-art in Big Data research and applications. The event is scheduled as follows

- Tuesday, June 16, 2020, Keynotes Session (9.45-12.30)
- Tuesday, June 16, 2020, Big Data – EU Perspective and Foresight (13.00-16.00)
- Wednesday, June 17, 2020, Knowledge Graphs & Big Data Processing (09.15-16.00)

In order to better organize the Q&A sessions and the PANEL Discussion that will take time on Tuesday, June 16, 2020, at 3 pm, we kindly asking you to fill in the following Questionnaire <https://forms.gle/jfLb97eKWK3hqaV68>

Thank you very much for being part of the LAMBDA Network.  
Please, follow us on  
Twitter, <https://twitter.com/Net4LAMBDA>  
LinkedIn, <https://www.linkedin.com/groups/12129621/>  
or  
Facebook, <https://www.facebook.com/valentina.janev.16>

For more details about the connection possibilities, please see the attached Information Pack.

If you have additional questions regarding the event, please contact [valentina.janev@institutepupin.com](mailto:valentina.janev@institutepupin.com)  
Sincerely,  
Valentina Janev

**Attachments:**

<a href="#">untitled-[1.1]</a>	1.3 k
<a href="#">BDA-2020-Invitation.pdf</a>	733 k
<a href="#">BDA 2020 Information Pack and Agenda.pdf</a>	451 k

Figure 7. Communication via the BDA-School mailing list (April 2020)

### 5.3 LAMBDA Platform

For easier and more effective collaboration among consortium members (e.g. facilitating joined paper and deliverable writing, version management, information sharing, stakeholders data-base management, etc.) and with stakeholders, the LAMBDA platform was established in month 1 of the project, see Figure 8.



Home

Webinar-1

Presentations from  
BDA School 2019

- My account
- Log out

Feedback

## Tools

- Add content

Type of organization: Research

Type of organization		
German National Library of Science and Technology	Germany	Research
MTA SZTAKI	Hungary	Research

Type of organization: Education

Type of organization		
The Belgrade Metropolitan University	Serbia	Education
The Ss. Cyril and Methodius University	Macedonia	Education
The University of Belgrade	Serbia	Education
The University of Montenegro	Montenegro	Education
The University of Niš	Serbia	Education
The University of Novi Sad	Serbia	Education
The University of Sarajevo	Bosnia and Herzegovina	Education
The University of Tuzla	Bosnia and Herzegovina	Education

• Page 1

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Figure 8. LAMBDA platform - contents at the private side

A Drupal-based platform by default offers three groups of users:

- Users who are not logged in, or *anonymous users*
- Users who are logged in, or *authenticated users* (Everybody with a valid e-mail address can register with the platform and become an authenticated user)
- *Administrative* user account that is automatically created with the installation.

Currently, 3 different user roles have been defined:

- *Partner*, full access to the private pages of the portal.
- *Associated Partner*, full access to the Stakeholder database (restricted) and contents in the Knowledge Repository.
- *Administrator*, for managing the whole content management system.

## 6. Conclusion

Overall, the experience gained from organizing the 1<sup>st</sup> and 2<sup>nd</sup> Summer School in Big Data Analytics is very positive. We see not only a clear benefit for the PUPIN employees but also for other participants at the School with heterogeneous educational background and professional level. The preparations for next year's summer school have already started and we anticipate the 3<sup>rd</sup> Summer School will take place in June 2021. More details about the sustainability activities will be given in Deliverable 3.7<sup>7</sup> [Belgrade BDA School \(Sustainability Plan\)](https://project-lambda.org/D3.7).

<sup>7</sup> <https://project-lambda.org/D3.7>