EDISON Champion universities Data Science programmes development and implementation

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# EDSF Illustrated Walkthrough Reporting Template

UC A/B: ABC  
Internal Champion XXX  
Mentor: YYY

* Prerequisites
* Competences and skills framework for Data Science (CF-DS)  
  <http://edison-project.eu/data-science-competence-framework-cf-ds>
* Data Science Body of Knowledge (DS-BoK)  
  <http://edison-project.eu/data-science-body-knowledge-ds-bok>
* Model Curriculum in Data Science (MC- DS)  
  <http://edison-project.eu/data-science-model-curriculum-mc-ds>
* EDISON\_DSP-profiles   
  <http://edison-project.eu/data-science-professional-profiles-definition-dsp>
* Summary of Data Science program and courses

Detailed, supplementary data in accompanying spreadsheet. Short summary here...

* Contact information (university/company, unit, contact person with email)
* General information about program
  + Designing a new Data Science program or course or analyzing/improving an existing one?
    - New DS program in the making? What have you already achieved, what are you planning to achieve, what is the current status of organizing / initiating new DS programs / courses?
  + What is the department that owns the program (can be more than one)?
  + Master or Bachelor program, vocational training (or another type)?
  + List of tracks, courses, number of students (if available)
* Usage of other European products (for existing programs or for using existing courses for new programs).
  + Is your program aligned with European e-Competence Framework?
  + Is your program aligned with European Qualifications Framework?
* Are teaching-learning activities (TLA) and assessment methods (such as Problem-based Learning) explicitly considered in your program?
* Initial EDSF Reflection
* Desk-based, assessing scientific and technical soundness, scope and relevance, readability, appearance and structure, usability, etc.
* Expectations w.r.t. applying EDSF?
* EDSF Application
* CF-DS: Specification of matching competence groups, competences and learning outcomes
* Balance of program w.r.t. Competence groups (what percentage of ECTS points per group)?
* Are learning outcomes defined? Do they follow Bloom’s Taxonomy?
* If learning outcomes defined, how do they align with EDISON learning outcomes in content and relative amount of ECTS points?
* Illustrative Examples (program, selected courses => complete mappings in xlsx)...
* Issues encountered... feedback (changes, additions, ...)
* BoK-DS: Specification of matching knowledge areas, topics
* Illustrative Examples (program, selected courses => complete mappings in xlsx)...
* Issues encountered... feedback (changes, additions, ...)
* Assignment of professional profiles targeted by program
* What professional profile do you cover (of profiles defined in EDISON)?
* Issues encountered... feedback (changes, additions, ...)
* MC-DS: Curricula Design and/or Evaluation

Depending on Use case A / B

* Gap analysis (remember to consider professional profiles, for existing programs or for using existing courses for new programs).
  + What are the gaps on the level of balance between competence groups?
  + What are the gaps on the level of learning outcomes?
* Summary and Outlook

Plans for addressing gaps/designing new program(s) so it/they complies with EDISON products.

## DS Programme Description Template

An excel spreadsheet with tables for DS programs and courses was provided.

|  |  |  |
| --- | --- | --- |
| **Field Name** |  | **Description** |
| *Title* | *Mandatory* | A meaningful short title |
| *Track Name* | *Optional* | Name of the track within the program |
| *Course List* | *Recommended* | URI to courses being part of the program, limited to the track if specified |
| *Organizer* | *Obligatory* | Institution, company, project organizing the program |
| *Type of Program* | *Mandatory* | Summer school, academic program, … |
| *Location* | *Mandatory* | A country and city (or full address) where the course takes place, unless online |
| *Start Date and Time* | *Mandatory* | The start date and time of the item (in ISO 8601 date format, preferably in UTC with time offset to local time zone). |
| *End Date and Time* | *Mandatory* | The end date and time of the item (in ISO 8601 date format, preferably in UTC with time offset to local time zone). |
| *URL* | *Mandatory* | Link to further information |
| *Contact* | *Mandatory* | Contact information of the responsible party (name, email or phone number) |
| *Language* | *Mandatory* | Language of instruction |
| *Level* | *Optional* | The level of studies following either Bologna or US approach |
| *Credit* | *Recommended* | Recommended for academic courses, including grading system |
| *Prerequisites* | *Recommended* | Required prior knowledge, preferably based on a BoK or taxonomy |
| *Target Audience* | *Optional* | E.g. “social scientists”, “biologists”, “data managers”, “policy makers in the UK”, or other |
| *Knowledge Areas* | *Recommended* | Knowledge areas covered by the program, based on the EDISON Body of Knowledge or Taxonomy |
| *Competence Groups* | *Recommended* | Competence groups covered by the program, based on the EDISON Competence Framework |
| *Learning Outcomes* | *Recommended* | Including objectives, preferably based on the EDISON Competence Framework |
| *Professional Profiles* | *Recommended* | Professional Profiles addressed by program |
| *Description* | *Recommended* | E.g. The program will provide a strong basis in administrative, programing, and algorithm design aspects of data intensive systems. |
| *Registration Deadline* | *Optional* | The date and time of the item (in ISO 8601 date format, preferably in UTC with time offset to local time zone). |
| *Payment* | *Optional* | Use three letter currency symbols (in ISO 4217 format) and payment methods |

# University of Amsterdam (UvA)

* Summary of Data Science program and courses
* Adam Belloum (track coordinator) Joined program between two universities (UvA and VUA), General information about program
  + Analyzing/improving an existing one
  + Computer Science
  + Track in Computer Science Master program
  + List of tracks, courses

Core Courses

* + - Large-Scale Data Engineering (Peter Boncz) –Sep/Oct
    - Web Data Processing Systems (Jacopo Urbani) –Nov/Dec
    - Information Visualization (Marcel Worring) - Jan
    - Data Mining Techniques (Mark Hoogendoorn) – Feb/Mar
    - Service Oriented Architecture and Cloud systems – Apr/May
    - Performance Engineering (Ana l. Varbanescu) –Apr/May
* **Usage of other European products**:
  + Is your program aligned with European e-Competence Framework? No
  + Is your program aligned with European Qualifications Framework? No
* **Are teaching-learning activities (TLA) and assessment methods (such as Problem-based Learning) explicitly considered in your program?** No
* Initial EDSF Reflection

Applying EDSF will help to identify the target *DS science profiles* for which the graduates of UVA MSc DS program match in term of competencies and skills. At the same time using EDSF will help to identify gaps in the current offering on UVA MSc DS program, the program is it has been designed a year ago may have overlooked DS competences groups that are important for the targeted DS Science profiles.

* EDSF Application
* CF-DS: Specification of matching competence groups, competences and learning outcomes
* **Balance of program w.r.t. Competence groups (what percentage of ECTS points per group)?**
  + Data Science Analytics competence group (**12**)
  + Data Science Engineering competence group (**18**)
  + Data Science Domain Knowledge (**6**)
  + Data Science Data Management (**0**)
  + Data Science Scientific Research Methods/ DSBPM Business Process (**36/6**)
* **Are learning outcomes defined? Do they follow Bloom’s Taxonomy?** Yes
  + UVA-VU data Science engineering track is part of the MSC program and mostly aim at assessment level
* **If learning outcomes defined, how do they align with EDISON learning outcomes in content and relative amount of ECTS points.**
  + UVA-VU data Science engineering track is focusing on the Engineering aspects of the Data science profession, so in terms of ECTS points the ECTS the program is a bit biased toward engineering competences and skills
* **Illustrative Examples**
  + All the 5 cores courses forming the DS engineering track have been mapped to the EDSF competence groups and Learning outcomes (cf. excel file)
* **Issues encountered and feedback**
  + Mapping was quite forward and logical. IT shows strong point of the UVA-VU data Science engineering program (courses are complementing each other in terms of focus on DS competencies and Learning Objectives). But it showed also the weak points of the program like no course in the program is covering the DS data management competencies explicitly, while this is quite important for the Engineering aspects of Data science which is the focus of the program. One action that followed the alignment of the UvA DS engineering program with the EDSF is a start to preparing a new course that will be added as en elective for track and which will be dedicated to data management.
* BoK-DS: Specification of matching knowledge areas, topics
* **Illustrative Examples**
  + Aligning UVA-VU data Science engineering courses with the EDSF in terms of competences and learning objectives was quite straightforward. Competences groups and learning objectives of courses where implicitly imbedded in the description of the courses and with the help of EDSF they could be identified and put in more clear and explicit manner.
* **Issues encountered and feedback**
  + Aligning UVA-VU data Science engineering courses with the EDSF in terms of competences and learning objectives required some expertise in the field, the only obstacles we faced is the fact that competences groups and learning objectives are described sometimes at different level of granularity and used different terminology
* Assignment of professional profiles targeted by program
* **What professional profile do you cover (of profiles defined in EDISON)?**

Primary focus is DSP01-03, DSP04-09, as a secondary focus is DSP10-13

* MC-DS: Curricula Design and/or Evaluation

Data science is an emerging field subject to frequents it is thus necessary to revise and adapt Data science curricula to keep them relevant to the data science job market. Because the EDISION methodology is taking into account Data Science professional profiles that are defined based on the ESCO occupation family profiles the EDISON data Science Framework can be easily adapted and thus form a good reference for institutions offering data science curricula and trainings to monitor the data science evolution and identify gaps in their Data Science offerings. Applying the EDSF to the UVA-VU data Science engineering program helped to identify a gap related to Data Management competences which are curial for many data science professional profiles but still not full covered in the current Data Science offerings.

* **Gap analysis** (remember to consider professional profiles, for existing programs or for using existing courses for new programs).
  + **What are the gaps on the level of balance between competence groups?**
    - The Aligning UVA-VU data Science engineering track is not covering the DS data management competencies explicitly, while this is quite important for the Engineering aspects of Data science which is the focus of the program
  + **What are the gaps on the level of learning outcomes?**
    - Because the current Aligning UVA-VU data Science engineering track does not consider the competencies related to Data management, the associated Learning Objectives are not considered as well at least not explicitly.
* Summary and Outlook

**Plans for addressing gaps/designing new program so it complies with EDISON products.**

As consequence of the alignment of UVA-VU data Science engineering track with the EDSF competences groups and Learning Objectives a new course that will address Data Management competences will be added to the of UVA-VU data Science engineering track. UVA staff members in concentration with the Research Data Alliance are defining the content of the course which be available as a series of trainings on *Research Data Management Literacy* and will be host at some of the RDA plenary meetings and thus available to All EDISON champion universities. The formal adoption of the topic Data Management in the UVA-VU data Science engineering track is expected for the next academic years).

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| **Field Name** | **Description** |
| ***Title*** | **Program Big Data Engineering** |
| *Track Name* | Big Data Engineering |
| *Course List* | <http://masters.vu.nl/en/programmes/computer-science-big-data-engineering/index.aspx> |
| *Organizer* | Joined program between the UvA and VUA |
| *Type of Program* | 2 year MSc computer Science program |
| *Location* | Amsterdam, The Netherlands |
| *Start Date and Time* | 05.09.2017 |
| *End Date and Time* | Not Applicable |
| *URL* | <http://masters.vu.nl/en/programmes/computer-science-big-data-engineering/index.aspx> |
| *Contact* | Adam Belloum a.s.z.belloum@uva.nl, +31205257514 |
| *Language* | English |
| *Level* | MSC level |
| *Credit* | Track within the MSc computer Science program (30 ECTS out of 120 ECTS), could be combined with the research project 3 ECTS , literature study 6 ETCS, Industrial internship 6 ETCS |
| *Prerequisites* | BA in computer Science, BA in information Sciences plus programming experience, BA in Business Analytics with programming experience |
| *Target Audience* | Technical data managers, Data analysts working with Big Data infrastucture |
| *Knowledge Areas* | KAG2-DSENG: Data Science Engineering group including Software and infrastructure engineering |
| *Competence Groups* | Data Science Engineering |
| *Learning Outcomes* | learning Objectives LO3:01,02,03,04 ( see EDISON Data Science Model Curriculum (MC-DS): Approach and Initial version) |
| *Professional Profiles* | Professional data science (DS04-09) (see EDISON Data Science Model Curriculum (MC-DS): Approach and Initial version) |
| *Description* | E.g. The program will provide a strong basis developing Data Analytics programms using big data infrastucture, fundamentals of cloud systems, and . |
| *Registration Deadline* | 1 June for Dutch students. 1 April for EU/EEA and non-EU/EEA students |
| *Payment* | EUR (bank tansfer) |

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| **Field Name** | **Description** |
| ***Title*** | **Large-Scale Data Engineering** |
| *Name of Presenter(s)* | Prof. dr. P.A. Boncz, CWI Amsterdam |
| *Organizer* | CWI Amsterdam |
| *Type of Course* | Course |
| *Related Program* | <http://masters.vu.nl/en/programmes/computer-science-big-data-engineering/index.aspx> |
| *Location* | Amsterdam The Netherlands |
| *Start Date and Time* | 31/09/2017 |
| *End Date and Time* | 28.10.2017 |
| *URL* | <http://event.cwi.nl/lsde/2016/index.shtml> |
| *Contact* | prof. dr. P.A. Boncz |
| *Language* | English |
| *Level* | MSc level |
| *Credit* | 6 ECTS, Grading system: practical assignment 30%, presentation of literature study 20%, written reports of the literature study 40% |
| *Prerequisites* | KAG2-DSENG: AL, AR, SE |
| *Target Audience* | DSP01-03, DSP04-09,DSP014-16, |
| *Knowledge Areas* | KAG2-DSENG, |
| *Competence Groups* | DSENG01, DSENG04, |
| *Learning Outcomes* | LO3.01, LO3.02, LO3.03, LO3.04 |
| *Description* | The course further gives an overview of the infrastructures currently at the disposal of a broad public to address large scale data analysis |
| *Registration Deadline* | Enrolment in interdepartmental courses of VU, UvA and AUC first semester 2016-2017, June [Thursday 2 June 10 am till Monday 6 June 11 pm (2016)] |
| *Payment* | Part of MSc program, the registration for the program covers the course |

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| ***Title*** | **Web Data Processing Systems** |
| *Name of Presenter(s)* | Jacopo Urbani, VUA |
| *Organizer* | Free University Amsterdam |
| *Type of Course* | course |
| *Related Program* | <http://masters.vu.nl/en/programmes/computer-science-big-data-engineering/index.aspx> |
| *Location* | Amsterdam The Netherlands |
| *Start Date and Time* | 31.10.2017 |
| *End Date and Time* | 23.12.2017 |
| *URL* | <http://www.vu.nl/en/study-guide/2016-2017/master/m-r/parallel-and-distributed-computer-systems/index.aspx?view=module&origin=50049360&id=51248205> |
| *Contact* | Jacobo Urbani, email j.urbani@vu.nl |
| *Language* | English |
| *Level* | MSc level |
| *Credit* | 6 ECTS, grading (practical assignment + final exam) |
| *Prerequisites* | KAG2-DSENG: AL, AR |
| *Target Audience* | DSP04-09, DSP010-013, |
| *Knowledge Areas* | KAG2-DSDA, |
| *Competence Groups* | DSDA01, DSDA02, DSD04 |
| *Learning Outcomes* | LO1.01, LO1.02, LO1.04 |
| *Description* | The course introduces the student to the most advanced systems and techniques which deal with Web data, with a particular emphasis on scalability. Important classes of problems concern: storage and retrieval of Web data, efficient entity disambiguation, knowledge extraction, expressive ontological inference |
| *Registration Deadline* | Enrolment in interdepartmental courses of VU, UvA and AUC first semester 2016-2017, June [ Thursday 2 June 10 am till Monday 6 June 11 pm (2016)] |
| *Payment* | Part of MSc program, the registration for the program covers the course |

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| --- | --- |
| ***Title*** | **Information Visualization** |
| *Name of Presenter(s)* | Macel Worring, UvA |
| *Organizer* | UVA |
| *Type of Course* | Course |
| *Related Program* | <http://masters.vu.nl/en/programmes/computer-science-big-data-engineering/index.aspx> |
| *Location* | Amsterdam The Netherlands |
| *Start Date and Time* | 02.01.2017 |
| *End Date and Time* | 31/02/2017 |
| *URL* | <http://studiegids.uva.nl/xmlpages/page/2016-2017/zoek-vak/vak/23828> |
| *Contact* | Macel Worring, email:m.worring@uva.nl |
| *Language* | English |
| *Level* | MSc level |
| *Credit* | 6 ECTS, Grading system: Intermediate Report 10%, Final demo 10%, final report 30%, written exam 50% |
| *Prerequisites* | KAG2-DSENG: AL, SE |
| *Target Audience* | DSP04-09, DSP010-013, |
| *Knowledge Areas* | KAG2-DSDA, |
| *Competence Groups* | DSD06 |
| *Learning Outcomes* | LO1.06 |
| *Description* | The course covers the development of methodologies which support the process of gaining insight in large and complex datasets by a combination of data analysis, machine learning, and information visualization. |
| *Registration Deadline* | Enrolment in interdepartmental courses of VU, UvA and AUC second semester 2016-2017, December 2016 |
| *Payment* | Part of MSc program, the registration for the program covers the course |

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| --- | --- |
| ***Title*** | **SOA-Cloud systems** |
| *Name of Presenter(s)* | Adam Belloum, UvA |
| *Organizer* | UvA |
| *Type of Course* | course |
| *Related Program* | <http://masters.vu.nl/en/programmes/computer-science-big-data-engineering/index.aspx> |
| *Location* | Amsterdam The Netherlands |
| *Start Date and Time* | 01.04.2017 |
| *End Date and Time* | 31.05.2017 |
| *URL* | <http://studiegids.uva.nl/xmlpages/page/2016-2017/zoek-vak/vak/29398> |
| *Contact* | Adam Belloum, email: a.s.z.belloum@uva.nl |
| *Language* | English |
| *Level* | MSc level |
| *Credit* | 6 ECTS, Grading system: practical assignment 60%, presentation of literature study 20%, written reports of the literature study 20% |
| *Prerequisites* | KAG2-DSENG: AL, SE |
| *Target Audience* | DSP01-03, DSP04-09 |
| *Knowledge Areas* | KAG2-DSENG, |
| *Competence Groups* | DSENG01, DSENG02, DSENG05 |
| *Learning Outcomes* | LO3.01, LO3.02, LO3.05 |
| *Description* | The course introduces students to the principles of web services and cloud system. students will learn about the different paradigms of cloud systems (IaaS, PaaS, SaaS), and understand the mechanisms and technologies behind each mode to successfully harness cloud resources. |
| *Registration Deadline* | Enrolment in interdepartmental courses of VU, UvA and AUC second semester 2016-2017, December 2016 |
| *Payment* | Part of MSc program, the registration for the program covers the course |

|  |  |
| --- | --- |
| ***Title*** | **Performance Engineering** |
| *Name of Presenter(s)* | Ana Varbanescu |
| *Organizer* | UvA Amsterdam |
| *Type of Course* | Course |
| *Related Program* | <http://masters.vu.nl/en/programmes/computer-science-big-data-engineering/index.aspx> |
| *Location* | Amsterdam The Netherlands |
| *Start Date and Time* | 01.04.2017 |
| *End Date and Time* | 31.05.2017 |
| *URL* | <http://studiegids.uva.nl/xmlpages/page/2016-2017/zoek-vak/vak/1544979> |
| *Contact* | Ana Varbanescu, email: a.l.varbanescu@uva.nl |
| *Language* | English |
| *Level* | MSc level |
| *Credit* | 6 ECTS, Grading system: practical assignment 25%, project 50%, exam 25% |
| *Prerequisites* | KAG2-DSENG: AL, AR |
| *Target Audience* | DSP01-03, DSP04-09 |
| *Knowledge Areas* | KAG2-DSENG, |
| *Competence Groups* | DSENG01, DSENG02, DSENG05 |
| *Learning Outcomes* | LO3.01, LO3.02, LO3.05 |
| *Description* | The course focuses on the modern aspects of performance engineering in the context of parallel algorithms and applications. Students learn to define and use performance metrics and measurement techniques, performance analysis, benchmarking and micro benchmarking, performance models (analytical and statistical), and performance prediction |
| *Registration Deadline* | Enrolment in interdepartmental courses of VU, UvA and AUC second semester 2016-2017, December 2016 |
| *Payment* | Part of MSc program, the registration for the program covers the course |

# University of Stavanger (UiS)

* Summary of Data Science program and courses
* Tomasz Wiktorski, Lector at University of Stavanger
  + Designing a new Data Science Master program at Faculty of Science and Technology
* **Usage of other European products:** No
* Initial EDSF Reflection

EDSF provides a good thinking framework to design data science program. In its current state it lack enough detail to provide specific support to design courses that are part of the program. The main element necessary to also provide that support is the connection between Competences/Learning Outcomes and BoK.

* **Expectations w.r.t. applying EDSF (Use Case description)?**

The goal is to design a new master program in Data Science, which should base to the biggest extent possible on existing courses. A difficulty is that based on internal policy UiS can only offer courses worth 10ECTS points, together with 30ECTS thesis, it means that student will only take 9 courses during the course of studies. An additional challenge is to allow for flexible design of the program to allow students with different backgrounds to take the program. The question is raised whether students missing programming competences could take such master’s program.

* EDSF Application
* CF-DS: Specification of matching competence groups, competences... and learning outcomes
* **Balance of program w.r.t. Competence groups (what percentage of ECTS points per group)?**

On the program level the balance is achieved. Because it’s a new program it aims to follow EDISON’s approach closely. The problem appears during the transfer of learning outcomes from program level to course level.

* **Are learning outcomes defined? Do they follow Bloom’s Taxonomy?**

On the course level learning outcomes are usually not defined properly. They do not explicitly consider Bloom’s Taxonomy. It is an additional difficulty in machine courses to program.

* **If learning outcomes defined, how do they align with EDISON learning outcomes in content and relative amount of ECTS points.**

While learning outcomes are defined, because of problems mentioned in first two points, it is impossible to determine answer to this question.

* **Illustrative Examples**

Let’s take course “Statistical modelling and simulation” as an example. It defined the following learning outcomes:

- be able to make and use statistical models for a number of technical, economic and scientific problems

- have knowledge of the strengths and limitations of some key techniques for statistical modelling

- be able to implement the models (R)

- carry out simulations of statistical models, analyse the results statistically, and

- to present results in a proper manner

- able to make assessments of uncertainty in the results

We can see that these learning outcomes cover the following EDISON LOs/Competences:

LO1.02 DSDA02 - Use appropriate statistical techniques on available data to deliver insights.

And partially

LO1.05 DSDA05 - Use different data analytics platforms to process complex data.

However, we can notice that learning outcomes are poorly defined. They don’t follow Bloom’s taxonomy and it is impossible to determine what level of competences they cover.

* **Issues encountered and feedback**

For many courses LOs are defined but it’s difficult to decide whether they actually correspond to program’s LOs. Course LO are often very specific and directed towards specific elements in BoK relevant for the course, while program LOs are general. Course LOs often don’t follow Bloom’s taxonomy what creates and additional challenge in matching.

* BoK-DS: Specification of matching knowledge areas, topics

Currenty BoK-DS is not yet ready for application on the course level, mostly because of missing links between BoK and LOs. On the program level BoK is not as important, so it wasn’t applied.

* Assignment of professional profiles targeted by program
* **What professional profile do you cover (of profiles defined in EDISON)?**

DSP04 Data Scientist

DSP07 Data Science (Application) Programmer/Engineer

* **Issues encountered and feedback**

A general challenge is that depending on the department that drives the program there is a push to debalance the program towards the competence group closest to departments core competences. This is both due to academic and economic reasons.

* MC-DS: Curricula Design and/or Evaluation

It is too early for this analysis.

* Summary and Outlook

There are two general actions planned. There is a need to update LOs of individual courses so it is possible to better evaluate them in the context of the whole program. The second action is to contribute to linking LOs with BoK, how it could be done is still to be determined.

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Program Data Science** |
| *Track Name* | CS, STAT, DOM |
| *Course List* | N/A |
| *Organizer* | University of Stavanger |
| *Type of Program* | Academic |
| *Location* | Stavanger, Norway |
| *Start Date and Time* | 15.08.2018 |
| *End Date and Time* | 15.06.2020 |
| *URL* | not yet |
| *Contact* | [tomasz.wiktorski@uis.no](mailto:tomasz.wiktorski@uis.no) |
| *Language* | English |
| *Level* | Master |
| *Credit* | 120 ECTS |
| *Prerequisites* | N/A |
| *Target Audience* | All |
| *Knowledge Areas* | DSP04 |
| *Competence Groups* | N/A |
| *Learning Outcomes* | N/A |
| *Professional Profiles* | N/A |
| *Description* | This is a very early draft, an idea of a new master program was proposed to the Faculty of Science and Technology and should be hopefully approved in December, only then will actual work start. Meaning of tracks is different than usually. Track describe the competences of students entering the Data Science program. For instance, students with Computer Science BSc can enter program and they will have realtively fewer CS courses, but more courses in Statistics/Data Analysis and Domain Knowledge. The same respectively for students comming with Statistics BSc and Domain Knowledge BSc. |
| *Registration Deadline* | 1.02.2017 tentative |
| *Payment* | FREE |

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| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Data-intensive Systems** |
| *Name of Presenter(s)* | Tomasz Wiktorski |
| *Organizer* | University of Stavanger |
| *Type of Course* | academic course |
| *Related Program* | Data Science |
| *Location* | Stavanger, Norway |
| *Start Date and Time* | 02.01.2019 |
| *End Date and Time* | 15.07.2019 |
| *URL* | http://www.uis.no/studies/study-courses/?categoryID=10648&parentcat=9835&code=DAT500\_1&name=Data-Intensive+systems |
| *Contact* | [tomasz.wiktorski@uis.no](mailto:tomasz.wiktorski@uis.no) |
| *Language* | English |
| *Level* | master |
| *Credit* | 10 ECTS |
| *Prerequisites* | N/A |
| *Target Audience* | N/A |
| *Knowledge Areas* | N/A |
| *Competence Groups* | N/A |
| *Learning Outcomes* | Characterize Hadoop job tracker, task tracker, scheduling issues, communications, and resource management; describe elements of Hadoop ecosystem and identify their applicability; describe and compare RDBMS, data warehouse, unstructured big data, and keyed files, and show how to apply them to typical data processing problems; understand algorithmic complexity of the worst case, expected case, and best case running time, and the orders of complexity; apply the analysis to real life algorithms; design, construct, test, and benchmark a small data processing cluster (based on Hadoop); analyze real-life problems and propose suitable solutions; construct programs based directly on MapReduce paradigm for typical problems; construct programs based on high-level tools (for MapReduce paradigm) for typical problems; analyze influence of peak and sustained bandwidth rate on system performance; evaluate, communicate and defend a data-intensive solution w.r.t. relevant criteria |
| *Description* | The course will provide a strong basis in administrative, programing, and algorithm design aspects of data intensive systems. |
| *Registration Deadline* | N/A |
| *Payment* | N/A |

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| ***Title*** | **Web Search and Data Mining** |
| *Name of Presenter(s)* | Krisztian Balog |
| *Organizer* | University of Stavanger |
| *Type of Course* | academic course |
| *Related Program* | Data Science |
| *Location* | Stavanger, Norway |
| *Start Date and Time* | 15.08.2018 |
| *End Date and Time* | 15.12.2018 |
| *URL* | <http://www.uis.no/studies/study-courses/?code=DAT630_1> |
| *Contact* | [krisztian.balog@uis.no](mailto:krisztian.balog@uis.no) |
| *Language* | English |
| *Level* | master |
| *Credit* | 10 ECTS |
| *Prerequisites* | N/A |
| *Target Audience* | N/A |
| *Knowledge Areas* | N/A |
| *Competence Groups* | N/A |
| *Learning Outcomes* | Theory and practice of data mining and information retrieval concepts, methods, and techniques. Process and prepare large-scale textual data collections for mining and retrieval.  Apply clustering, classification, and ranking methods to a range of information access problems. Evaluate results and perform error analysis. Understanding of the strengths and limitations of popular data mining and information retrieval techniques. Being able to identify promising business applications, participate in and lead such projects. |
| *Description* | The course offers an introduction to techniques and methods for processing, mining, and searching in massive (mostly textual) data collections. Topics range from statistics to machine learning, natural language processing, and information retrieval.  The course will study various applications and provide an opportunity for hands-on experimentation with state-of-the-art algorithms using existing software tools and data collections. |
| *Registration Deadline* | N/A |
| *Payment* | N/A |

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| --- | --- |
| ***Title*** | **Statistical modeling and simulation** |
| *Name of Presenter(s)* | Bjørn Henrik Auestad, Dag Bjarne Tjøstheim, Tore Selland Kleppe |
| *Organizer* | University of Stavanger |
| *Type of Course* | academic course |
| *Related Program* | Data Science |
| *Location* | Stavanger, Norway |
| *Start Date and Time* | 15.08.2018 |
| *End Date and Time* | 15.12.2018 |
| *URL* | <http://www.uis.no/studies/study-courses/?code=STA510_1> |
| *Contact* | Mandatory |
| *Language* | English |
| *Level* | master |
| *Credit* | 10 ECTS |
| *Prerequisites* | N/A |
| *Target Audience* | N/A |
| *Knowledge Areas* | N/A |
| *Competence Groups* | N/A |
| *Learning Outcomes* | be able to make and use statistical models for a number of technical, economic and scientific problems; have knowledge of the strengths and limitations of some key techniques for statistical modeling; be able to implement the models (R); carry out simulations of statistical models, analyze the results statistically, and to present results in a proper manner; able to make assessments of uncertainty in the results |
| *Description* | This course provides a foundation for problem solving in technology, economics and science using statistical modeling, simulation and analysis. The exam is done with PC on PC-lab, parts on PCs and parts on plain paper. |
| *Registration Deadline* | N/A |
| *Payment* | N/A |

# Goethe University Frankfurt (GOE)

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| **Field Name** | **Description** |
| ***Title*** | **Big Data Technology** |
| *Name of Presenter(s)* | Prof. Dott. Ing. Roberto V. Zicari, Todor Ivanov and Kim Hee - Goethe University |
| *Organizer* | GOETHE University - Big Data Lab |
| *Type of Course* | Academic course |
| *Related Program* | N/A |
| *Location* | Frankfurt am Main(Germany) |
| *Start Date and Time* | 23.10.2017 |
| *End Date and Time* | 05.02.2018 |
| *URL* | http://www.bigdata.uni-frankfurt.de/big-data-technologies-ws-2017/ |
| *Contact* | Roberto Zicari, zicari@dbis.cs.uni-frankfurt.de |
| *Language* | English and German |
| *Level* | Master Students in Computer Science, Bio informatics and Business informatics |
| *Credit* | 8 CPs |
| *Prerequisites* | programming skills, knowledge of Python, algorithms and data structures |
| *Target Audience* | N/A |
| *Knowledge Areas* | DSA, DSE |
| *Competence Groups* | DSENG03, DSENG04, DSENG06; DSDM02, DSDM05; |
| *Learning Outcomes* | N/A |
| *Description* | N/A |
| *Registration Deadline* | 19 october 2017 |
| *Payment* | N/A |

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| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Introduction to Data Science** |
| *Name of Presenter(s)* | Dr. Jochen L. Leidner (Thomson Reuters) and Kim Hee Goethe University) |
| *Organizer* | Goethe University |
| *Type of Course* | Academic course |
| *Related Program* | N/A |
| *Location* | Frankfurt am Main (Germany) |
| *Start Date and Time* | 29 May 2017 |
| *End Date and Time* | 15 sept 2017 |
| *URL* | http://www.bigdata.uni-frankfurt.de/introduction-data-science/ |
| *Contact* | Hee@dbis.cs.uni-frankfurt.de |
| *Language* | English and German |
| *Level* | Master Students in Computer Science, Bio informatics and Business informatics |
| *Credit* | 5 CPs |
| *Prerequisites* | programming skills, knowledge of Python, algorithms and data structures |
| *Target Audience* | N/A |
| *Knowledge Areas* | DSA, DSE |
| *Competence Groups* | DSENG03, DSENG04, DSENG06; DSDM02, DSDM05; |
| *Learning Outcomes* | N/A |
| *Description* | The goal of this compact course is to give participants a first gentle introduction and solid conceptual grounding in what has been called ‘data science’, i.e. experimental work that is data-driven and empirical. The focus is on methodology, defining an experimental protocol, devising hypotheses, thinking about measuring success, but also on more practical approaches like basic machine learning methods (both supervised and unsupervised) and natural language processing approaches (like part-of-speech tagging, named entity recognition/classification/resolution, and parsing) and the introduction to popular tools. The course also demonstrates some practical applications of the techniques shown, and deepens the students’ skills via practical exercises.  The lecture is delivered over 4 weeks of calendar time and consists of 2 three-day blocks of 3 hours of lectures followed by 2 days of 2.5 hours of exercises/tutorials each). It targets Master’s level students. By the end of the course, participants will be able to analyze data-sets, and to create their own predictive classifieds and visualizations. |
| *Registration Deadline* | 19 Oct 2017 |
| *Payment* | N/A |

# University of Bedfortshire (BEDS)

* Summary of Data Science program and courses

From the academic year 2017/18 on, the University of Bedfordshire will offer two undergraduate Data Science programmes: BSc (Hons) Data and Information Systems and BSc (Hons) Computing and Data Science. Both programmes emphasise the information systems/computer science view on Data Science whilst still including mathematical aspects.

* Contact information

Ingo Frommholz, School of Computer Science and Technology, Park Square, Luton LU1 3JU, UK

* General information about program
  + The School of Computer Science has been running a BSc (Hons) Data Science programme in its Milton Keynes campus. However, this programme has not recruited well, likely due to a ‘labelling problem’. To attract more students to Data Science, the following actions were performed:
    - Rename BSc (Hons) Data Science to BSc (Hons) Computing and Data Science
    - Replace the old BSc (Hons) Information Systems programme with BSc (Hons) Information and Data Systems

Both new programmes are currently subject to final university approval and it is expected they will be offered for the next academic year 2017/18.

The School of Computer Science and Technologies considers the creation of new MSc-level programmes on Data Science and on Information Retrieval, respectively.

* + School of Computer Science and Technology is responsible for these Bachelor programs
  + List of tracks, courses, number of students (if available)  
    Courses: see spreadsheet. Student numbers not available so far, expected are less than 10 initially.
* Usage of other European products (for existing programs or for using existing courses for new programs).
  + Is your program aligned with European e-Competence Framework? **no**
  + Is your program aligned with European Qualifications Framework? **no**
* Are teaching-learning activities (TLA) and assessment methods (such as Problem-based Learning) explicitly considered in your program?  
    
  Students are assessed in a variety of ways, including coursework, group and individual projects, portfolios, essays, presentations or exams. Students will also produce software artefacts in the area of their specialism. Constant feedback and advice from a supervisory or module team will be provided.
* Initial EDSF Reflection

We considered EDISON for the design and approval of our two newly created programmes mentioned above as follows:

* CF-DS and BoK-DS were used as ‘benchmarks’ for our programmes and as guidance for creating the curricula (e.g., by embedding our modules in competence groups to make sure we cover all relevant aspects of Data Science)
* The EDISON outcome gave use reassurance that our programmes are in line with the demands of the Data Science market
* The fact that through EDISON we are well connected with Europe-wide Data Science experts was well received by the panel in the approval event of our programmes.

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| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **BSc (Hons) Information and Data Systems** |
| *Track Name* |  |
| *Course List* | Introduction to Software Development Principles of Programming Computer Systems Structure Mathematics of Data Operational Information Security Management Distributed Data Management and Semantics Decision Support Systems and Data Mining Systems Development and Modern Database Practices Professional Practice Year (Computer Science and Technology, optional) Research Methodologies and Emerging Technologies Data Engineering, Presentation and Retrieval Social and Professional Project Management Undergraduate Project |
| *Organizer* | School of Computer Science and Technology, Faculty for Creative Arts and Technology, University of Bedfordshire |
| *Type of Program* | Academic program |
| *Location* | Luton, UK |
| *Start Date and Time* | 01.10.2017 |
| *End Date and Time* | 30.06.2020 |
| *URL* | tba |
| *Contact* | Ingo Frommholz <ingo.frommholz@beds.ac.uk> |
| *Language* | English |
| *Level* | England FHEQ Level 6 (see https://www.naric.org.uk/Europass/documents/ds\_chart.pdf) |
| *Credit* | 360 |
| *Prerequisites* | A-levels or equivalent. At least one grade of at least ‘B’ in Mathematics or Physics is required (or equivalent qualification for international applicants) |
| *Target Audience* | Data Science Professionals, Database and Network Professionals, Data Science Technology Professionals |
| *Knowledge Areas* | Data Science Analytics/Mathematics of computing/Mathematical software; Data Science Analytics/Computing methodologies/Articifical Intelligence/Search metholdologies; Data Science Analytics/Computing Methodologies/Machine learning; Data Science Analytics/Information Systems/Information Systems Applications;Data Science Data Management/Data management systems; Data Science Engineering/Software and its engierring/Software creation and management; Data Science Engineering/Software and its engierring/Software notations and tools; Domain knowledge/Applied computing/Document management and text processing  DS-BoK Release 2: KU1.01.01, KU1.01.02, KU1.01.14, KU1.02.02, KU1.02.03, KU1.02.08, KU1.04.02, KU1.04.05, KU2.01.01, KU2.01.07, KU2.01.02, KU2.02.02, KU2.02.08, KU2.06.03, KU2.06.05, KU2.07.01, KU2.07.05, KU3.01.02, KU3.01.04, KU3.01.07, KU3.02.02, KU3.02.04, KU3.03.05, KU3.06.01, KU3.06.02, KU3.06.04, KU4.01.01, KU4.01.02, KU4.01.04, KU4.01.06, KA04.01 DSRMP.02/PM Project Management |
| *Competence Groups* | Domain Expertise, Research, Data Analytics, Analytic Systems, Algorithms, Engineering Competencies, Scientific Methods |
| *Learning Outcomes* | • LO1 Research, analyse and evaluate technologies and organisational problems in a range of contexts and to choose and implement appropriate solutions • LO2 Demonstrate skills that allow you to conceptualise and apply formal and informal creative thinking techniques towards the development and implementation of relevant data and information systems into the real world • LO3 Demonstrate skills in project management in relation to the delivery of projects within the constraints of client critical success factors • LO4 Express, interpret and critically evaluate issues concerning the law and professional ethics in the context of information systems • LO5 Demonstrate investigative skills in the area of information and data systems through completion of substantial assignments, reports, presentations and case studies • LO6 Apply skills in a rational argument, objective interpretation of evidence, judgement and decision making towards the planning, analysis and successful development of information systems within complex organisational environments • LO7 Understand and extend existing information systems and data science concepts, theories and practices following professional conventions and standards  • LO8 Critically describe and evaluate future trends in information and data systems development • LO9 Work effectively within a systems development team and be able to explain the conditions necessary for successful team working |
| *Professional Profiles* |  |
| *Description* | The course will provide you with academic and technical skills to analyse, interpret and make sense of how to handle the huge amount of ubiquitous data created daily. It will enable you to meet the demands of tomorrow’s information society and draws from our expert staff in Information Systems, Data Science and Computing. |
| *Registration Deadline* |  |
| *Payment* |  |

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| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **BSc (Hons) Computing and Data Science** |
| *Track Name* |  |
| *Course List* | Introduction to Software Development Principles of Programming Computer Systems Structure Mathematics of Data Operational Information Security Management Distributed Data Management and Semantics Decision Support Systems and Data Mining Concepts and Technologies of Artificial Intelligence Professional Practice Year (Computer Science and Technology, optional) Research Methodologies and Emerging Technologies Data Engineering, Presentation and Retrieval Social and Professional Project Management Undergraduate Project |
| *Organizer* | School of Computer Science and Technology, Faculty for Creative Arts and Technology, University of Bedfordshire |
| *Type of Program* | Academic program |
| *Location* | Milton Keynes, UK |
| *Start Date and Time* | 01.10.2017 |
| *End Date and Time* | 30.06.2020 |
| *URL* | tba |
| *Contact* | Ingo Frommholz <ingo.frommholz@beds.ac.uk> |
| *Language* | English |
| *Level* | England FHEQ Level 6 (see https://www.naric.org.uk/Europass/documents/ds\_chart.pdf) |
| *Credit* | 360 |
| *Prerequisites* | A-levels or equivalent. At least one grade of at least ‘B’ in Mathematics or Physics is required (or equivalent qualification for international applicants) |
| *Target Audience* | Data Science Professionals, Database and Network Professionals, Data Science Technology Professionals |
| *Knowledge Areas* | Data Science Analytics/Mathematics of computing/Mathematical software; Data Science Analytics/Computing methodologies/Articifical Intelligence/Search metholdologies; Data Science Analytics/Computing Methodologies/Machine learning; Data Science Analytics/Information Systems/Information Systems Applications;Data Science Data Management/Data management systems; Data Science Engineering/Software and its engineering/Software creation and management; Data Science Engineering/Software and its engierring/Software notations and tools; Domain knowledge/Applied computing/Document management and text processing  DS-BoK Release 2: KU1.01.01, KU1.01.02, KU1.01.14, KU1.02.02, KU1.02.03, KU1.02.08, KU1.04.02, KU1.04.05, KU2.01.02, KU2.02.02, KU2.02.08, KU2.06.03, KU2.06.05, KU2.07.01, KU2.07.05, KU3.01.02, KU3.01.04, KU3.01.07, KU3.02.02, KU3.02.04, KU3.03.05, KU3.06.01, KU3.06.02, KU3.06.04, KU4.01.01, KU4.01.02, KU4.01.04, KU4.01.06, KA04.01 DSRMP.02/PM Project Management |
| *Competence Groups* | Domain Expertise, Research, Data Analytics, Analytic Systems, Algorithms, Engineering Competencies, Scientific Methods |
| *Learning Outcomes* | • LO1: Demonstrate a thorough understanding of the relevant areas of computing and data science such as: data storage and retrieval, data presentation, data security, data mining and data management; as well as the societal context in which data is used.  • LO2: Critically apply and reflect upon data analysis and modelling, presentation and other essential concepts along with the fundamental principles of data retrieval in the context of industry relevant case studies, showing judgement in using the right analysis and presentation tools and techniques.  • LO3: Professionally conduct a major project, using problem-solving and evaluation skills relevant to Data Science that addresses all aspects of a software development cycle including design, implementation and documentation in a coherent and consistent way.  • LO4: Demonstrate transferable skills and an ability to work under guidance and as a team member.  • LO5: Identify how the methods, tools and techniques of data science are applied within a professional, legal and ethical framework and develop an understanding of the need of continuing professional development. • LO6: Critically discuss societal applications of Data Science. In order to qualify for the award of BSc (Hons) Computing and Data Science (with Professional Practice year) students will need to meet all of the outcomes above and: • LO7: Demonstrate knowledge and analytical understanding of professional practice by successfully completing an approved period of approved work place practice. |
| *Professional Profiles* |  |
| *Description* | The course will provide you with academic and technical skills to analyse, interpret and make sense of the huge amount of ubiquitous data created daily. It will enable you to meet the demands of tomorrow’s information society. |
| *Registration Deadline* |  |
| *Payment* |  |

# Lodz University of Technology (TUL)

* Summary of Data Science program and courses
* Lodz University of Technology (TUL), Institute of Electronics

Contact person: Aleksandra Królak, aleksandra.krolak@p.lodz.pl

* + Analyzing/improving existing Bachelor program at Institute of Electronics, Department of Medical Electronics in cooperation with Institute of Materials Science and Engineering, Department of Microelectronics and Computer Science and  Department of Material and Commodity Sciences and Textile Metrology
  + List of tracks, courses

Single track: Biomedical Engineering

List of courses: <http://programy.p.lodz.pl/kierunekSiatka.jsp?l=en&w=Biomedical%20Engineering&p=5493&stopien=first-cycle%20programme&tryb=full-time>

* **Usage of other European products (for existing programs or for using existing courses for new programs).**
  + **Is your program aligned with European e-Competence Framework?**

partly

* + **Is your program aligned with European Qualifications Framework?**

partly

* **Are teaching-learning activities (TLA) and assessment methods (such as Problem-based Learning) explicitly considered in your program?**

Activity types included in the program are mainly Interactivity focus (group assignments), Critical thinking (response to an assigned text) and Problem solving (group projects including design and implementation of an algorithm, device, etc.). In the program for 4th semester Team Project is planned as a 10 ECTS course that is realized in the Problem Based Learning form.

* Initial EDSF Reflection
* The EDSF documents should be readable and understandable for people working on development of academic study programs. Available releases are well structured and contain a lot of important, useful and well illustrated information about DS framework, BoK and professional profiles. Some of the introductions are in my opinion a bit too extensive, however allow a reader to take a deeper look at the related approaches. For persons with initial knowledge about the content of EDSF documents it is easy to get needed information from the text. Persons who get the documents for the first time need to put relatively much effort to understand everything and use the documents efficiently.
* **Expectations w.r.t. applying EDSF (Use Case description)?**

EDSF documents include competence framework, body of knowledge, model curriculum and professional profiles description. Information contained in these documents should give clear guidelines how to develop new study program or modify existing one for student education at Bachelor and/or Master level in Data Science related discipline. In case of Biomedical Engineering study program one of the possible tracks may be Biomedical Data Analytics. EDSF documents should be the source of information about proportions of courses from different fields according to Bloom’s Taxonomy for Data Science and should facilitate completing required at Polish universities study program descriptions of: initial requirements, learning outcomes it three groups (knowledge, skills, social competences) and occupational profiles of graduates.

* EDSF Application
* CF-DS: Specification of matching competence groups, competences... and learning outcomes
* **Balance of program w.r.t. Competence groups (what percentage of ECTS points per group)?**

The courses can be divided into 5 categories where 3 of them refer to the DS competence groups: General courses (foreign language, physical education) 10.5%, basic technical courses (Chemistry, Physics, Mechanical Engineering, etc.) 11.4%, DS Analytics 25.2%, DS Engineering 25.7%, Domain Knowledge 27.2%.

* **Are learning outcomes defined? Do they follow Bloom’s Taxonomy?**

Learning outcomes are defined for each course in three groups: knowledge, skills, social competences, what is required by Polish Ministry of Science and Higher Education. LOs with their description are selected from lists developed by particular universities, in this case by Lodz University of Technology, and are not aligned with Bloom’s Taxonomy

* **If learning outcomes defined, how do they align with EDISON learning outcomes in content and relative amount of ECTS points.**

LO1-DA – 11% (22ECTS)

LO2-DM – 0% (1ECTS)

LO3-ENG – 13% (27ECTS)

LO4-RM – 0% (0ECTS)

LO5-BPM – 5% (10ECTS)

* **Illustrative Examples**

|  |  |
| --- | --- |
| **Competence group** | **TUL Biomedical Engineering program courses** |
| DS Analytics | Information Technology, Algorithms and Data Structures, Mathematics 1 and 2, Image Processing and Computer Graphics, Medical Informatics |
| DS Engineering | Signal Processing, Control Systems, Sensors, Medical Imaging |
| Domain Knowledge | Biomaterials 1 and 2, Medical Electronics, Implants and Artificial Organs, Microsystems in Medical Applications |

* **Issues encountered and feedback**

In my opinion students at Lodz University of Technology have too much basic technical courses in the first and second semester. They are provided with a lot of theoretical knowledge that is not related to practical examples. These courses are taught in large groups for different study programs. A good idea would be to add different projects or laboratories matching particular study program that would show usefulness of presented theory in future professional life.

* BoK-DS: Specification of matching knowledge areas, topics
* **Illustrative Examples**

|  |  |
| --- | --- |
| **Knowledge area groups** | **TUL Biomedical Engineering program courses** |
| KAG1-DSDA | None |
| KAG2-DSENG | Algorithms and Data Structures, Signal Processing, Medical Informatics |
| KAG3-DSDM | Information Technology, Medical Informatics |
| KAG4-DSRM | Signal Processing, Medical Informatics |
| KAG5-DSBPM | None |

* **Issues encountered and feedback**

TUL Biomedical Engineering program is more focused on engineering than on DS related fields. However in todays world in many “biomedical engineering” fields, such as biomedical signal acquisition and analysis, biomedical image processing or medical devices design it is necessary to have knowledge about methods of analysis, storing, securing and visualization of large amounts of data. The current program should be modified so that all above mentioned topics are covered.

* Assignment of professional profiles targeted by program
* **What professional profile do you cover (of profiles defined in EDISON)?**

DSP04, DSP05, DSP07, DSP08

* **Issues encountered and feedback:**

The program should include courses related to Data Bases what is necessary for any manipulation of large amounts of data. Graduate students report the need of introducing teaching of more programming languages in the study program.

* MC-DS: Curricula Design and/or Evaluation
* **Gap analysis (remember to consider professional profiles, for existing programs or for using existing courses for new programs).**
  + **What are the gaps on the level of balance between competence groups?**

The balance between 3 main EDSF competence groups is kept (around 25%-26%-27%). However the courses in TUL Biomedical Engineering program related to DS Analytics and DS Engineering do not cover all needed fields indicated in EDSF, such as Statistics, Research methods, Databases, Data visualization, Data security.

* + **What are the gaps on the level of learning outcomes?**

On the level of Learning Outcomes there are huge gaps with relation to MC-DS defined in EDISON. Due to the fact that the LOs defined in the program of TUL Biomedical Engineering are done in accordance with Polish standards they coincide in about 10% only

* Summary and Outlook

It is necessary to introduce large changes in the program of Biomedical Engineering (TUL) so that it matches all requirements presented in EDISON documents. All learning outcomes and professional profiles must be rearrange according to EDISON guidelines. More courses related do data analysis, data visualization, data transmission and security must be introduced. Necessary is to include Database course in the program. As a member of the Teaching Committee for Biomedical Engineering program I will suggest such changes to the rest of the members.

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Biomedical Engineering** |
| *Track Name* | Biomedical Engineering |
| *Course List* | http://programy.p.lodz.pl/kierunekSiatka.jsp?l=en&w=Biomedical%20Engineering&p=4291&stopien=first-cycle%20programme&tryb=full-time |
| *Organizer* | Lodz University of Technology |
| *Type of Program* | Academic Program |
| *Location* | Łódź, Poland |
| *Start Date and Time* | 01.10.2017 08:00 |
| *End Date and Time* | 20.02.2020 23:59 |
| *URL* | http://programy.p.lodz.pl/?l=en&s=karta-opisu-programu-ksztalcenia&pk=Biomedical%20Engineering&pkId=221 |
| *Contact* | Aleksandra Królak aleksandra.krolak@p.lodz.pl |
| *Language* | English |
| *Level* | BSc |
| *Credit* | 210 ECTS (30ECTS per semester) |
| *Prerequisites* | Mathematics, Physics, Biology, Chemistry |
| *Target Audience* | Engineers, Data Sceintists, biomaterial engineer |
| *Knowledge Areas* |  |
| *Competence Groups* |  |
| *Learning Outcomes* | [http://programy.p.lodz.pl/?l=en&s=efekty-ksztalcenia-wiedza&pk=Biomedical%20Engineering&pkId=221 http://programy.p.lodz.pl/?l=en&s=efekty-ksztalcenia-umiejetnosci&pk=Biomedical%20Engineering&pkId=221 http://programy.p.lodz.pl/?l=en&s=efekty-ksztalcenia-kompetencje-spoleczne&pk=Biomedical%20Engineering&pkId=221](http://programy.p.lodz.pl/?l=en&s=efekty-ksztalcenia-wiedza&pk=Biomedical%20Engineering&pkId=221) |
| *Professional Profiles* | Graduates who hold an engineering degree in Biomedical Engineering have the ability to use modern equipment, diagnostic and therapeutic methods that implement modern electronic and teleinformation techniques. They are trained and qualified in terms of: - co-operation with medical doctors on + integration, operation, use and maintenance of medical equipment + the use of diagnostic and therapeutic systems - manufacturing and design of medical, diagnostic and therapeutic devices - implementation of projects related to biomedical engineering. Graduates may be employed in hospitals, clinics, and other health system units, companies that manufacture equipment and medical devices, departments of accreditation and attestation of instruments and medical devices; companies that design and implement medical devices, research institutions, consulting services and medical administration. Graduates are familiar with a foreign language at the B2 level, and have the ability to use the technical language in the field of biomedical engineering. Graduates are prepared to enroll on second level studies and work in national and international interdisciplinary teams. |
| *Description* | The program provides strong basis in engineering, medical equipment design and biomaterial technologies. Students acquire knowledge from the fild of material engineering, electronics, textronics and computer technologies for biomedical applications |
| *Registration Deadline* | end of July |
| *Payment* | no payment |

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| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Information Technology** |
| *Organizer* | Lodz University of Technology |
| *Type of Course* | academic course |
| *Related Program* | http://programy.p.lodz.pl/przedmiot.jsp?l=en&idPrzedmiotu=146771&s=1&j=0&w=Biomedical%20Engineering |
| *Location* | Lodz, Poland, Lodz University of Technology |
| *Start Date and Time* | 01.10.2017 |
| *End Date and Time* | 20.02.2018 |
| *URL* | http://programy.p.lodz.pl/przedmiot.jsp?l=en&idPrzedmiotu=146771&s=1&j=0&w=Biomedical%20Engineering |
| *Contact* | [aleksandra.krolak@p.lodz.pl](mailto:aleksandra.krolak@p.lodz.pl) |
| *Language* | English |
| *Level* | BSc |
| *Credit* | 3 ECTS |
| *Prerequisites* | Basic skills in computer operation |
| *Target Audience* | data managers |
| *Knowledge Areas* | KAG3 |
| *Competence Groups* | DS Analytics |
| *Learning Outcomes* | LO01 |
| *Description* | Modern computer systems and information technology are presented for the students. The lecture includes computer hardware and system software. Data transmission, different communication channels and their parameters, development of local area networks have been discussed. Laboratory classes comprise tasks concerning networking software, applications from MS-Office package and software for graphical processing. |
| *Registration Deadline* | N/A |
| *Payment* | no payment |

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Algorithms and Data Structures** |
| *Organizer* | Lodz University of Technology |
| *Type of Course* | academic course |
| *Related Program* | http://programy.p.lodz.pl/przedmiot.jsp?l=en&idPrzedmiotu=158570&s=1&j=0&w=Biomedical%20Engineering |
| *Location* | Lodz, Poland, Lodz University of Technology |
| *Start Date and Time* | 01.10.2017 |
| *End Date and Time* | 20.02.2018 |
| *URL* | http://programy.p.lodz.pl/przedmiot.jsp?l=en&idPrzedmiotu=158570&s=1&j=0&w=Biomedical%20Engineering |
| *Contact* | [aleksandra.krolak@p.lodz.pl](mailto:aleksandra.krolak@p.lodz.pl) |
| *Language* | English |
| *Level* | BSc |
| *Credit* | 2 ECTS |
| *Prerequisites* | none |
| *Target Audience* | N/A |
| *Knowledge Areas* | KAG2 |
| *Competence Groups* | DS Analytics |
| *Learning Outcomes* | LO01 |
| *Description* | The course will provide a strong basis in programing and algorithm design |
| *Registration Deadline* | N/A |
| *Payment* | no payment |

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Signal Processing** |
| *Organizer* | Lodz University of Technology |
| *Type of Course* | academic course |
| *Related Program* | http://programy.p.lodz.pl/przedmiot.jsp?l=en&idPrzedmiotu=150713&s=3&j=0&w=Biomedical%20Engineering |
| *Location* | Lodz, Poland, Lodz University of Technology |
| *Start Date and Time* | 01.10.2018 |
| *End Date and Time* | 20.02.2019 |
| *URL* | http://programy.p.lodz.pl/przedmiot.jsp?l=en&idPrzedmiotu=150713&s=3&j=0&w=Biomedical%20Engineering |
| *Contact* | [aleksandra.krolak@p.lodz.pl](mailto:aleksandra.krolak@p.lodz.pl) |
| *Language* | English |
| *Level* | BSc |
| *Credit* | 5 ECTS |
| *Prerequisites* | The student knows fundamentals of mathematical analysis and matrix algebra |
| *Target Audience* | engineers, data scientists |
| *Knowledge Areas* | KAG2, KAG4 |
| *Competence Groups* | DS Engineering |
| *Learning Outcomes* | LO01, LO03, LO04, LO05 |
| *Description* | Teaching the studnets how to apply digital techniques for recording, processing and analysis of signals, with special emphasis on biomedical signals |
| *Registration Deadline* | N/A |
| *Payment* | no payment |

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Medical Informatics** |
| *Organizer* | Lodz University of Technology |
| *Type of Course* | academic course |
| *Related Program* | http://programy.p.lodz.pl/przedmiot.jsp?l=en&idPrzedmiotu=150726&s=5&j=0&w=Biomedical%20Engineering |
| *Location* | Lodz, Poland, Lodz University of Technology |
| *Start Date and Time* | 01.10.2019 |
| *End Date and Time* | 20.02.2020 |
| *URL* | http://programy.p.lodz.pl/przedmiot.jsp?l=en&idPrzedmiotu=150726&s=5&j=0&w=Biomedical%20Engineering |
| *Contact* | [aleksandra.krolak@p.lodz.pl](mailto:aleksandra.krolak@p.lodz.pl) |
| *Language* | English |
| *Level* | BSc |
| *Credit* | 3 ECTS |
| *Prerequisites* | none |
| *Target Audience* | data managers, biomedical engineers |
| *Knowledge Areas* | KAG2, KAG3, KAG4 |
| *Competence Groups* | DS Engineering |
| *Learning Outcomes* | LO01, LO03, LO04, LO05 |
| *Description* | The knowledge transmission in the field Medical Informatics. |
| *Registration Deadline* | N/A |
| *Payment* | no payment |

# University of Perugia (UoP)

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Master Degree in Data Science** |
| *Track Name* | N/A |
| *Course List* | http://www.unipg.it/en/courses/bachelor-master-degrees/course-catalogue-2016-17?controller=corso&layout=default&corso=666&tab=DID#ancora-curriculum-1464 |
| *Organizer* | University of Perugia - Dept of Engineering |
| *Type of Program* | Academic Program |
| *Location* | Perugia (Italy) |
| *Start Date and Time* | 1 November 2017 |
| *End Date and Time* | 28 February 2019 |
| *URL* | http://www.unipg.it/en/courses/bachelor-master-degrees/course-catalogue-2016-17?controller=corso&layout=default&anno=2016&corso=666 |
| *Contact* | Paolo Valigi - valigi@unipg.it |
| *Language* | Italian and English |
| *Level* | N/A |
| *Credit* | 120 ECTS |
| *Prerequisites* | An essential requirement /prerequisite to access to the master degree program is the possession of a bachelor's degree, or another qualification obtained abroad and recognized as valid, in one of the following classes:  L-08 Degrees in Information Engineering  L-09 Degrees in Industrial Engineering  L-30 Degrees in Physical Sciences and Technologies L-31 Degrees in Computer Science  L-35 Degrees in Mathematical Sciences  L-41 degrees in Statistics  or corresponding classes according to the dm 509/99:  09 Degrees in Information Engineering  10 Degrees in Industrial Engineering  26 Degrees in Computer Science  25 Degrees in Physical Sciences and Technologies  32 Mathematics  37 Statistics  In addition to bachelor's degree in one of the above classes, access requires possession of curricular requirements and adequate personal preparation.  In particular:  - The curricular requirements will be evaluated in terms of possession of a sufficient number of credits in the areas related to the basic and the characterizing activities of the L8 class with particular reference to the areas Electronics Engineering, Computer Engineering and Telecommunications Engineering.  - Personal preparation is assessed by setting defined thresholds based on the first-level degree mark, or on the grade obtained in various tests, or a combination thereof.  For candidates who do not pass the required thresholds, the degree program prepares a test of personal preparation. The procedures for verification of the curricular requirements and personal preparation are set out in the Regulations of the Degree program. |
| *Target Audience* | Bachelor Students |
| *Knowledge Areas* | DSA, DSE, DSBP |
| *Competence Groups* | DSDA01, DSDA02, DSDA04, DSDS06; DSENG01, DSENG02, DSENG03, DSENG06; DSDM02; DSDM05; DSBA01, DSBA03 |
| *Learning Outcomes* | The Master of Science in Computer Engineering and Robotics aims to train engineers in computing and automation, and to provide its students the references and the ability to contribute to innovation and to stay continuously updated with new technologies.  As specific objectives, the course aims to train experts in areas of great interest and development, such as: the processing and extraction of large amounts of data information; tools and technologies for robotics and industrial applications, in civil and service industry context. |
| *Professional Profiles* | DSP04, DSP05, DSP06, DSP07, DSP08, DSP17 |
| *Description* | The curriculum is as follows:  - In the first year course students will acquire advanced knowledge on digital signal processing and statistical analysis in the engineering field. They’ll study the models and the main algorithmic techniques for machine learning and data mining, which represent an important knowledge for the modern computer science engineer's training.  - In a second step (which involves both the first and the second year), students focus on specialized disciplines more oriented to information technology (such as software engineering, computer security, distributed programming and computational complexity), or on specialized disciplines more oriented to the field of robotics (such as control, automation, and embedded electronic systems). In addition, in order to deepen knowledge in the field of Data Science and of Advanced Robotics, students may face: (i)topics regarding analysis and management of Big Data, visual analytics, business analytics; (Ii) or topics on computer vision, intelligent Mobile robotics, cloud robotics.  - students faces also supplementary teaching in telecommunications ( especially on virtual networks, architectures and cloud services, and wireless networks), which are important to set the educational offer in relation to specifics demands that have emerged in the context analysis.  - An important part of the training process is the use of various specialized laboratories, which allow students to deepen practical aspects through project activities, independently or by working in team.  - The student also has the possibility to conduct internships and thesis in national or international companies/universities/research centre in order to experience and extend their practical skills, and to encourage future integration into the working world. The training activities are typically concentrated in the second year, towards the end of the training course.  The final exam, usually based on a project activity, involves the preparation of a thesis about a subject in one or more areas of interest of the Board of the master degree course.  To broaden their experiences and their culture, students can access to internationalization programs, performing abroad, at universities or prestigious research centers, a part of their studies (exams or thesis),  At the end of their training, graduates of the course will be able to operate, design and produce complex and innovative systems in several major application areas, including for example: social sciences (social network analysis), IT security and national security (detection and cyber attack treatment and analysis of criminal networks), information systems and computer networks (management, processing and transmission of large data sets), computer systems (design and software development environment) |
| *Registration Deadline* | 5 November 2017 |
| *Payment* | EUR |

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Data Science Master Certificate** |
| *Track Name* | N/A |
| *Course List* | http://masterds.unipg.it - |
| *Organizer* | University of Perugia - Sponsorship from Engineering, IBM |
| *Type of Program* | MSc |
| *Location* | Perugia (Italy) |
| *Start Date and Time* | 2 February 2017 |
| *End Date and Time* | 5 November 2017 |
| *URL* | http://www.unipg.it/didattica/procedure-amministrative/accesso-corsi-numero-programmato/master?layout=concorso&idConcorso=838 |
| *Contact* | Gianluca Reali, reali@unipg.it |
| *Language* | English and Italian |
| *Level* | The level of studies following either Bologna or US approach |
| *Credit* | Recommended for academic courses, including grading system |
| *Prerequisites* | Master’s Degree or equivalent academic title. For graduates possessing Master’s Degrees in Information and Industrial Engineering (Classes from LM-20 to LM-22 and from LM25 to LM-34), Computer Sciences (LM-18), Mathematics (LM-40), Physics (LM-17) and Statistics (LM-83), |
| *Target Audience* | Students and practitioners |
| *Knowledge Areas* | DSA, DSE, DSBP |
| *Competence Groups* | DSDA01, DSDA02, DSDA04, DSDS06; DSENG03, DSENG06; DSDM02; DSDM05; DSBA01, DSBA03 |
| *Learning Outcomes* | N/A |
| *Professional Profiles* | DSP04, DSP01, DSP06, DSP08 |
| *Description* | The master, organized by the **Department of Engineering, University of Perugia,** aims to train **Data Scientist**, the new data professional. This practitioner, as a data expert, must be able to create new business strategies in statistic, computer science, economic and management fields; today, the purchase of such multidisciplinary competences are, those mainly request for the corporate data development and enhancement. |
| *Registration Deadline* | 10 January 2017 |
| *Payment* | 3000 Eur |

# Lucerne School of Information Technology (HSLU)

#### Major in Data Engineering and Data Science

* Describing the program and listing the courses

The first step was to describe the program and to list the courses, see chapter 2. Based on this catalogue, the learning objectives could be gathered. This involved communication with many course responsibles and a coordination within a committee (Fachgruppe Data Science & Engineering).

The Lucerne School of Information Technology offers Bachelor’s degree programs in information technology and business informatics. For both programs students choose a major, that is a specialization in the third year of study in a specific IT topic of 24 ECTS. Starting in September 2016, we offer a major in *data engineering and data science*, for both BSc in information technology and in business informatics. This major requires students to choose the courses statistics and NoSQL Databases as a prerequisite. On the intermediate level (second year of study for full time students) On the major level (third year of study for full time students) the following courses are taught:

* Contact information (university, unit, contact person with email)
  + Lucerne University of Applied Science and Arts  
    School of Information Technology  
    Prof. Dr. Michael Kaufmann  
    m.kaufmann@hslu.ch
* General information about program
* We are designing a new program
* The School of Information Technology owns the program
* Two Bachelor’s degree programs with 25 ECTS Major in Data Engineering and Data Science
  + Bachelor of Science Hochschule Luzern/FHZ in Wirtschaftsinformatik, (WI)
  + Bachelor of Science Hochschule Luzern/FHZ in Informatik, Major in Data Engineering and Data Science (I)
* List of tracks, courses (other than standard I or WI courses)
* Mandatory prerequisites:
  + Statistics I
  + Statistics II
  + Database Systems (I) or Data Management + NoSQL Databases (WI)
* Major modules
  + Data Science Basics
  + Big Data Lab
  + Data Warehousing
  + Business Intelligence
  + Machine Learning
  + Text- & Social Media Analytics
* We have a project track, where at least 42 ECTS are problem-based.
* Initial EDSF Reflection
* Desk-based, assessing scientific and technical soundness, scope and relevance, readability, appearance and structure, usability, etc.

The EDSF seems technically and theoretically very sound, as its BOK is aligned with existing books and specific data science competencies are added based on the needs of real world entities by analysis of job offerings. Also, EDSF addresses the scientific method as a guideline for data science professionals. The EDSF is highly relevant, because the need for data science education is growing, the demand in the industry is there and it is not matched by educational offerings. There is a need for structure, guidelines, frameworks, and model curricula in the field of Data Science.

The scope is okay, but rather broad in range. A more focused description for end-users could be valuable. The readability is questionable, because the mentioned documents (see prerequisites) have clearly a research character. The whole process of mental and social construction of a new academic field is visible, rather than only the condensed results of that process. Therefore, to enhance the usability of the EDSF, I suggest to provide a new additional document for end users (Universities that only want to apply the results. That document should contain only a summary of all relevant results (i.e., without distracting descriptions of the path to these results), together with specific paths to apply thesis results.

* Expectations w.r.t. applying EDSF (Use Case description)?

We expect to use EDSF as a measure of quality management for designing our new major in data engineering and data science. By aligning our courses with an international benchmark, we can identify and close gaps and thus improve the quality of our offering. Since the new Degree programmes started in 2016, the major level will be tought from 2018. The course outline and learning objectives have been defined, but now we still have time to fine-tune the details and to add relevant objectives if there are significant gaps w.r.t. EDSF.

* Listing the internally planned Learning Objectives and mapping to EDISON

Our program is still being set up, and first courses will start in Autumn 2018. Gathering all the learning objectives for the mapping meant asking the responsible persons of the course if they already have a draft version of the course concept including learning objectives. Also, it became clear that the program might profit even more from the application of EDSF than we thought before.

* Statistics I

LO1.06 I

LO01.02 I, II

* F1: The students present data with the most suitable graphical representation.
  + LO1.06 I
* F2: They calculate mean values, scattering masses and index numbers with adequate tools.
  + LO01.02 I
* F3: Students know the method of the least squares. They formulate and calculate models and determine trends from time series.
  + LO01.02 I
* M1: Students create tables and graphs using a spreadsheet program such as LibreOffice or Excel.
  + LO01.02 I
* M2: You interpret the collected data correctly.
  + LO01.02 II
* P1: The students formulate statistical results for the recipient.
  + LO01.02 II
* P2: They reflect on the experience of group work.
  + -
* Statistics II
* F1: Students know that sample-based statements are subject to a random uncertainty.
  + -
* F2: They calculate confidence intervals and perform statistical hypothesis tests.
  + LO01.02 I, LO4.01. I
* M1: Students interpret results correctly. They draw the right conclusions.
  + LO01.02 II
* P1: The students reflect on the experience gained during group work.
  + -
* Database Systems (I) or Data Management + NoSQL Databases (WI)

LO3.04 I, II, III

LO2.02 I, II

* Relational databases:
* F3: Convert a conceptual data model to a relational schema. (RS)
* F4: Normalize data models. (NF)
* F5: Understand the principles of Relational Algebra. (R1)
* F6: Apply Relational Algebra operators. (R2)
* F7: Apply SQL basics. (S1)
* F8: Apply advanced SQL. (S 2)
* F9: Use programs from databases. (DP)
* F10: Ensure semantic integrity of a database. (DI)
* F11: Ensure data security in databases. (DS)
* F12: Maintain consistency in database transactions. (TR)
* F13: Relational expressions are converted equivalently. (R3)
* F14: Optimize the performance of database queries. (AO) Postrelation databases:
* F15: Understanding multi-dimensional databases. (MD)
* F16: Apply object-relational Mapper. (OM)
* NoSQL databases:
* F17: Explain Big Data and show appropriate strategies and tools. (BD)
* F18: Define and motivate NoSQL databases. (ND)
* F19: Implement a graphical database. (GD)
* F20: Implement a document database. (DD)
* F21: Implement a key-value database. (SW)
* F22: Implement a column family database. (SF)
* Data Science Basics

LO1.01 I II III

* F1: Explain what is meant by data science today
* F2: describe the different tasks of a Data Engineer and a Data Scientist
* F3: Demonstrate different methodologies / models in the data science environment
* F4; The programming language R for problems in the DE & DS environment
* F5: Connect to a BigData platform (Hadoop-Zoo) and make simple analyses in R
* F5: Evaluate ethical concerns in Big Data Projects
* M1: Integrate autodidactically into a new technology
* M3: Organizing a project and meeting deadlines meet the goals
* M4: summarize and report on project results
* P1: Organize yourself in the group
* P2: Hold a presentation in front of an audience
* P3: submit work results on time
* P4: Give peer feedback
* P5: Accept peer feedback
* Big Data Lab

LO1.04 I, II, III

LO1.05 I, II, III

LO3.06 III

* F1: Get to know and use proven and up-to-date tools in the area of BigData and NoSQL.
* F2: You can assess which tools are best suited for which questions.
* F3: Deepen in at least one area independently and present this knowledge.
* F4: Deepening into a new little-known tool in the BigData / NoSQL environment and presenting this knowledge.
* Data Warehousing

LO2.02 I, II, II

L02.03 I

LO2.04 I, II, III

* F1: The students know the basic concepts, models and architectures of analytical data stocks.
* F2: Students are able to model analytical data (from the operational side).
* F3: Students can choose the models that are most problem-oriented
* F4: Students know the problems of denormalization and data quality in heterogeneous data collection.
* F5: Students analyze structured and unstructured data.
* F6: Students know the metadata modeling.
* M1: Students know the big picture of data warehousing.
* M2: The students know the most important tools for (transformation into) analytical data sets.
* M3: Students use the right DWH tool in the right place at the right time.
* P1: The students know and recognize data warehousing not as a self-purpose but as an instrumental discipline in a business environment.
* P2: Students are aware of the problem of collecting and evaluating personal data.
* P3: The students act as competent, socially conscious interlocutors and co-decision-makers in decisions about data warehousing.
* Business Intelligence

LO5.01 I, II, III

LO01.03 I, II

* F1: Students know the basics and processes of business intelligence.
* F2: Students are able to determine information needs and to implement appropriate processes for obtaining the information.
* F3: The students know the typical fields of application of Business Intelligence.
* F4: The students can use common procedures in the treated areas.
* M1: The students know the most important methods of business intelligence.
* M2: Students use the appropriate means of Business Intelligence to develop adequate decision-making tools.
* M3: The students know which problems and solutions are used in the typical fields of application.
* M4: The students are able to use the methods described adequately.
* P1: Students are familiar with the way in which information is designed to be user-friendly. They can convey knowledge gained in a suitable way.
* P2: Students know that informed decisions depend on adequate information and are aware of the impact of incorrect or inadequate information on decision-making.
* P3: Students understand the hurdle of BI results and the communication of the findings in everyday life. They are able to com- municate the acquired knowledge competently.
* P4: Students will see how the procedures in the treated areas can be transferred to other areas. They make proposals for the use of BI techniques in adjacent fields of application.
* Machine Learning

LO1.03 I, II, III

* Describe a typical task of data analysis as a machine learning problem
* Suggest an adequate machine learning procedure for a given problem situation and implement it using a framework
* From the result of a machine learning procedure, draw correct conclusions on the original problem situation
* Plan and evaluate the evaluation of a machine learning process and present the derived findings correctly and in detail
* Assess the quality of a machine learning process, assess and, if necessary, propose improvements
* Text- & Social Media Analytics

LO3.06 II

LO1.04 II

* F1: explaining basic concepts and connections in the field of text and social media analytics
* F2: Unstructure and use unstructured text from the web, social media, and document collections using the appropriate tools (Twitter API, Nutch, Solr, Tika, Lucene, MoreLikeThis)
* F3: Access social media data via Twitter API
* F4: Parsing a text source (the web, a document base) with Apache Nutch
* F5: Extract full text from Office, PDF, HTML, etc. with Apache Tika
* F6: Indexing in Apache Lucene and retrieving it via search queries
* F7: With MoreLikeThis, the texts indexed in Lucene are automatically tagged with key words and related documents
* F8: Programming a simple text categorization and recommender system that extracts relevant keywords based on a document and suggests related, similar documents
* M2: Integrate autodidactically into a new technology
* M3: Organizing a project and meeting deadlines meet the goals
* M4: summarize and report on project results
* P1: Organize yourself in the group
* P2: Hold a presentation in front of an audience
* P3: submit work results
* P4: Give peer feedback
* P5: Accept peer feedback
* Data Visualization

L01.06 I. II. III

* F1: Media Configurations: Which (visual) media are suitable for which form of communication?
* F2: perception and cognition: visual variables ( "preattentive variables"), gestalt laws, affordances, mental models, scripts, storyboards
* F3: Representation context: explanatory -> presentation; Exploratory -> interactive analysis; Rhetorical -> conviction
* F4: IBCS communication standards: Knowledge and effective application of international business communication standards
* F5: Tufte's Guidelines: 1. Graphical Excellence; 2. Visual Integrity; 3. Maximizing the data-ink ratio; 4. Aesthetic Elegance
* F6: Interactive data visualization: Knowledge and practical implementation of the Shneiderman mantra: overview first, filter, detail on demand
* F7: Representation forms for data structures: hierarchical, relational (network), temporal, spatial (geospatial), spatiotemporal, textual
* F8: Introduction Cartography: Advantages and disadvantages of different projection possibilities, metadata, layer concepts.
* F9: Dashboard design
* F10: Historical retrospect
* Gathering the relevant Information of the EDSF

For the matching and gap analysis, the relevant learning objectives, competence groups, etc, from the EDSF had to be gathered. First, the documents mentioned in Section 1 were downloaded. Because the terminology of EDISON is rather cryptic, the actual deliverables were classified according to the following structure, and relevant corresponding EDSF content was assigned to get an overview.

Because the deliverables were not provided in word format, extracting relevant information was not straight-forward. The necessary pages were cut out with Acrobat Pro and exported to Word Format. Thus, a summarized handbook was created that facilitated the following mapping. This file is available as an annex to this document.

* Mapping to the EDISON resources

The following questions have to be answered by the case study:

* CF-DS: Specification of matching competence groups, competences... and learning outcomes

The following competence groups, competences and learning outcomes match: (details, see the list of our courses, learning objectives, and mapping to EDISON above. The mapping has been encoded there on the detailed level of learning outcomes)

Legend:

Learning outcome level I level II level III

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| DSDA01  Use predictive analytics to analyse big data and discover new relations  Data Science Basics Machine Learning | DSDM01  Develop and  Implement data strategy, in particular, in a form of Data Management Plan (DMP) | DSENG01  Use engineering principles to research, design, prototype, data analytics applications, or develop structures, instruments, machines, experiments, processes, systems | DSRM01  Create new understandings and capabilities by using the scientificmethod (hypothesis, test, and evaluation) or similar engineering research and development methods  Statistics II | DSDK01  Understand business and provide insight, translate unstructured business problems into an abstract mathematical framework  Business Intelligence |
| DSDA02  Use appropriate statistical techniques on available data to deliver insights  Satistics I / II | DSDM02  Develop and implement relevant data models, including metadata  Database Systems  Data Warehousing | DSENG02  Develop and apply computational solutions to domain related problems using wide range of data analytics platforms  Big Data Lab | DSRM02  Direct systematic study toward a fuller knowledge or understanding of the observable facts, and discovers new approaches to achieve research or organisational goals | DSDK02  Use data to improve existing services or develop new services |
| DSDA03  Develop specialized analytics to  Enable agile decision making  Business Intelligence  Machine Learning | DSDM03  Collect and integrate different data source and provide them for further analysis  Data Warehousing | DSENG03  Develops specialized data analysis tools to support executive decision making | DSRM03  Undertakes creative work, making systematic use of investigation, experimentation, discover or revise knowledge of reality, and uses this knowledge to devise new applications | DSDK03  Participate strategically and tactically in financial decisions that impact management and organizations |
| DSDA04  Research and analyse complex datsets, combine different sources andtypes of data to improve analysis. Big Data Lab | DSDM04  Develop and maintain a historical data repository of analysis results (data provenance)  Data Warehosing | DSENG04  Design, build, operate relational non-relational databases  Database Systems | DSRM04  Ability to translate strategies into action plans and follow through to completion. | DSDK04  Provides scientific, technical, and analytic support services to other organisational roles |
| DSDA05  Use different  data analytics platforms to process complex data  Big Data Lab | DSDM05  Ensure data quality, accessibility, publications (data curation) | DSENG05  Develop solutions for secure and reliable data access | DSRM05  Contribute to and influence the development of organizational objectives | DSDK05  Analyse customer data to identify/optimise customer relations actions |
| DSDA06  Visualise complex and variable data.  Statistics I  Data Visualization | DSDM06  Manage IPR and ethical issues in data management | DSENG06  Prototype new data analytics applications  Text & Social Media Analytics  Big Data Lab | DERM06  Apply ingenuity to complex problems, develop innovative ideas | DSDK06  Analyse multiple data sources for marketing purposes |

* **Balance of program w.r.t. Competence groups (what percentage of ECTS points per group)?**
  + DSDA 44%
  + DSDM 21%
  + DSDE 23%
  + DSRM 3%
  + DSDK 9%
* **Are learning outcomes defined? Do they follow Bloom’s Taxonomy?**

Learning outcomes are clearly defined. They do not follow Bloom’s Taxonomy. We classfy our learning outcomes into the groups professional competence, method competence and person competence.

* **If learning outcomes defined, how do they align with EDISON learning outcomes in content and relative amount of ECTS points.**

See table above

* **Issues encountered and feedback**

The excel is too cumbersome. It is already quite an abstract task to generate a mapping. I think free text should suffice.

The numbering of all items is good, it can be used as reference

It is good that competence groups and knowledge area groups correspond. However, the order is different, which makes it confusing.

Also, there are redundant knowledge units.

It was difficult to gather all the relevant information in the different EDISON docs. It would be helpful to summarize the main points in a short Handbook. I send you an example.

* BoK-DS: Specification of matching knowledge areas, topics

The following knowledge areas match (marked in green)

* KAG1-DSDA: Data Analytics

|  |  |
| --- | --- |
| **Knowledge Areas (KA)** | **Suggested Knowledge Units (KU)** |
| Theory of computation | Design and Analysis of Algorithms |
| Machine Learning Theory |
| Game Theory & Mechanism design |
| EXTENSIBILITY Point: Theory of computation |
| Mathematics of computing | Discrete Mathematics and Graph Theory |
| Probability & Statistics |
| Probabilistic reasoning |
| Statistical methods, including descriptive statistics, exploratory data analysis (EDA) and confirmatory data analysis (CDA) |
| Information theory |
| Mathematical analysis |
| Mathematical software and tools |
| EXTENSIBILITY Point: Mathematics of Data Science (computing) |
| Computing methodologies | Artificial Intelligence |
| Natural Language Processing |
| Knowledge Representation and Reasoning |
| Data mining and knowledge discovery |
| Text analysis, Data mining |
| Text analytics including statistical, linguistic, and structural techniques to analyse structured and unstructured data |
| Machine Learning theory and algorithms |
| Classification methods |
| EXTENSIBILITY Point: Computing methodologies |
| Information systems (to support Data Science applications) | Decision Analysis and Decision Support Systems |
| Data warehousing and Data Mining |
| Data Analysis and statistics |
| Multimedia information systems |
|  | Data Mining |
| Predictive analytics and predictive forecasting |
| EXTENSIBILITY Point: Information systems |
| Big Data Technologies and Systems | Big Data algorithm for large scale data processing |
| Big Data Analytics |
| Big Data systems |
| Big Data algorithms for data ingest, pre-processing, and visualisation |
| Big Data analytics platforms and tools (including Hadoop, Spark, and cloud based Big Data services) |
| Big Data systems for application domains |
| EXTENSIBILITY Point: Information systems |
| Computer systems organisation for Big Data applications (including high performance networks) | Parallel and Distributed Computer Architecture |
| Computer networks: architectures and protocols |
| Computer networks for high- performance computing and Big Data infrastructure |
| EXTENSIBILITY Point: |
| Big Data software organisation and engineering | Software (systems) architectures |
| Requirements engineering and software systems development |
| Large and ultra-large scale software systems organisation |
| Cloud enabled applications development |
|  |

* KAG2-DSENG: Data Science Engineering

|  |  |
| --- | --- |
| **Knowledge Areas (KA)** | **Suggested Knowledge Units (KU)** |
| Computer systems organisation for Big Data applications (including high performance networks) | Parallel and Distributed Computer Architecture |
| Computer networks: architectures and protocols |
| Computer networks for high- performance computing and Big Data infrastructure |
| EXTENSIBILITY Point: |
| Big Data software organisation and engineering | Software (systems) architectures |
| Requirements engineering and software systems development |
| Large and ultra-large scale software systems organisation |
| Cloud enabled applications development |
|  |
| EXTENSIBILITY Point: |
| Modelling and simulation | Modelling and simulation theory and techniques (general and domain oriented) |
| Large scale modelling and simulation systems |
| EXTENSIBILITY Point: |
| Big Data systems organisation and management | Enterprise information systems |
| Large scale data storage and data management systems |
| Collaborative and social computing systems and tools |
| EXTENSIBILITY Point: |
| Big Data (Data Science) applications design | Programming languages for Big Data analytics: R, python, others |
| Models and languages for complex interlinked data presentation and visualisation |
| EXTENSIBILITY Point: |
| Infrastructure and platforms for Data Science applications group: | Cloud Computing architecture and services |
| Cloud Computing Engineering (infrastructure and services design, management and operation) |
| Big Data and cloud based systems design and development |
| Cloud based applications and services operation and management |
| Big Data Analytics platforms (including cloud based) |
| Big Data Infrastructure: services and components, including data storage infrastructure |
| Data security and protection |
| EXTENSIBILITY Point: |
| Software engineering and management | Software requirements and design |
| Software engineering models and methods |
| Software quality assurance |
| Agile development methods, platforms and tools |
| DevOps and continuous deployment and improvement paradigm |
| EXTENSIBILITY Point: |

* KAG3-DSDM: Data Management

|  |  |
| --- | --- |
| **Knowledge Areas (KA)** | **Suggested Knowledge Units (KU)** |
| Data management systems | Database management systems |
| Database design and models |
| Data Modelling, Databases and Database Management Systems |
| Data Models and Query Languages |
| Database administration |
| EXTENSIBILITY Point: |
| Digital libraries and archives | Digital libraries and archives organisation |
| Information Retrieval |
| Data curation and provenance |
| Search Engines technologies |
| EXTENSIBILITY Point: |
| Data Management and Enterprise data infrastructure | Data management, including Reference and Master Data |
| Data Warehousing and Business Intelligence |
| Data storage and operations |
| Data archives/storage compliance and certification |
| Metadata, linked data, provenance |
| Data infrastructure, data registries and data factories |
| Data security and protection |
| Data governance, data quality, data Integration and Interoperability |
| Data Management Planning |
| Responsible data use, data privacy, ethical principles, legal issues |
| EXTENSIBILITY Point: |
| General principles and concepts in | Data type registries, PID, metadata |
| Data Management and organisation | Research data infrastructure, Open Science, Open Data, Open Access, ORCID |
| Data infrastructure compliance and certification |
| Ethical principle and data privacy |
| EXTENSIBILITY Point: |

* KAG4-DSRM: Scientific and Research Methods

|  |  |
| --- | --- |
| **Knowledge Areas (KA)** | **Suggested Knowledge Units (KU)** |
| Scientific/Research Methods | Research methodology, paradigms and research cycle |
| Modelling and experiment planning |
| Data selection and quality evaluation |
| Use cases analysis: research infrastructures and projects |
| Research data management plan and ethical issues |
| EXTENSIBILITY Point: |

* KAG5-DSBPM: Business process management

|  |  |
| --- | --- |
| **Knowledge Areas (KA)** | **Suggested Knowledge Units (KU)** |
| Business Process Management | Business processes and operations |
| Project scope and risk management |
| EXTENSIBILITY Point: |
| Business Analysis organisation and management | Business Analysis Planning and Monitoring |
| Requirements Analysis and Design Definition |
| Requirements Life Cycle Management (from inception to retirement) |
| Solution Evaluation and improvements recommendation |
| EXTENSIBILITY Point: |
| Business analysis and enterprise organisation | Agile Data Driven methodologies, processes and enterprises |
| Use cases analysis: business and industry |
| EXTENSIBILITY Point: |

* Assignment of professional profiles targeted by program

The following professional profiles are targeted by our programs: DSP03, DSP06, DSP07, DSP14, DSP15, DSP17

* MC-DS: Curricula Design and/or Evaluation
* **Gap analysis (remember to consider professional profiles, for existing programs or for using existing courses for new programs).**

See table above

* **What are the gaps on the level of balance between competence groups?**

Our program is for BSC IT and Business IT. We focus on Data Science Analytics and Engineering. The other competence groups, especially research method and domain knowledge, we have large gaps

* **What are the gaps on the level of learning outcomes?**

See table above. Learning outcomes and competencies match, the only difference is the expertise level, and this is encoded using the colors in the table,

* Our Approach

The simple approach was to to align the process of application of the EDSF with our own eixisting curriculum structure. We took the following steps:

* Describing our program.
* Describing the initial reflection
* Gathering the relvant information on our internal courses including learning outcomes
  + This was time consuming because we had to coordinate with all professors and lecturers that teach in the program and also with the directors
* Gathering the relevant information on EDISON.
  + This was abstract and complex, because the information is hidden within four different documents. We had to search and find the relevant pieces. Copying it into a summary document was difficult because the files were in PDF, not Word
* Map the EDISON resources with our program.
  + Every single course was mapped to competencies and learning outcomes. Competencies and groups can be directly derived from the learning outcomes. There is a mapping and corresponcencebetween them.
* Gap analysis.
  + Instead of using the Excel, which are cumbersome and inefficient, we used the overview table for competencies and groups CFDS Table 4.1 and color-coded it to summarize the mapping result. This is also much more human readable, as the gaps can be seen easily.
* Description of our approach
  + The approach is also reflected in the document structure.

This task turned out to be quite

* Summary and Outlook

We will discuss the results in the Fachgruppe Data Science & Engineering. We will discuss to include more compentencies of EDISON in our Curriculum.

Since our program is a specialization of existing BSC IT and business IT, we cannot cover all the topics. However, we are currently evaluating to implement a Master’s program for applied data science. There we use the EDISON guidelines for curriculum development. The program is not ready to be matched based on the level of individual learning outcomes. Yet, we have structured our initial concept starting with EDISON professional profiles mapped to competency groups, and we have identified possible courses using the EDISON Knowledge units. The framework helps us greatly to structure the formidable task of designing a new program from scratch. Aligning it with an existing EU framework gives our concept more credibility, it simplifies the task so that we can choose from a catalogue of elements, and this ensures the quality because we apply excellent preliminary work.

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| *Title* | Bachelor of Science Hochschule Luzern/FHZ in Wirtschaftsinformatik |
| ***Track Name*** | **Major in Data Engineering and Data Science** |
| *Course List* | https://www.hslu.ch/de-ch/informatik/studium/bachelor/majors/kernmodule/%20#kernmoduledataengineering |
| *Organizer* | Lucerne University of Applied Sciences and Arts, School of Information Technology |
| *Type of Program* | Academic program |
| *Location* | Rotkreuz, Switzerland |
| *Start Date and Time* | Fall 2016 |
| *End Date and Time* | N/A |
| *URL* | N/A |
| *Contact* | [m.kaufmann@hslu.ch](mailto:m.kaufmann@hslu.ch) |
| *Language* | German |
| *Level* | Bachelor |
| *Credit* | 180 ECTS |
| *Prerequisites* | Matura (A-Level) plus 1 year of professional experience in IT |
| *Target Audience* | IT professionals |
| *Knowledge Areas* | Described above |
| *Competence Groups* | Described above |
| *Learning Outcomes* | Described above |
| *Professional Profiles* | Described above |
| *Description* | Described above |
| *Registration Deadline* | N/A |
| *Payment* | N/A |

The courses Statistics I, Statistics II, Database Systems, Data Science Basics, Big Data Lab, Data Warehousing, Machine Learning, Business Intelligence are described in detail in the walkthrough above.

They will all have a structure like the following:

|  |  |
| --- | --- |
| **Field Name** | **Description** |
| ***Title*** | **Statistics I** |
| *Name of Presenter(s)* | N/A |
| *Organizer* | Lucerne University of Applied Sciences and Arts, School of Information Technology |
| *Type of Course* | Academic Course |
| *Related Program* | Recommended |
| *Location* | Rotkreuz, Switzerland |
| *Start Date and Time* | Mandatory |
| *End Date and Time* | Mandatory |
| *URL* | Mandatory |
| *Contact* | [m.kaufmann@hslu.ch](mailto:m.kaufmann@hslu.ch) |
| *Language* | German |
| *Level* | Bachelor's Degree |
| *Credit* | 3 ECTS |
| *Prerequisites* | N/A |
| *Target Audience* | Optional |
| *Knowledge Areas* | Described above |
| *Competence Groups* | Described above |
| *Learning Outcomes* | Described above |
| *Description* | Described above |
| *Registration Deadline* | N/A |
| *Payment* | N/A |

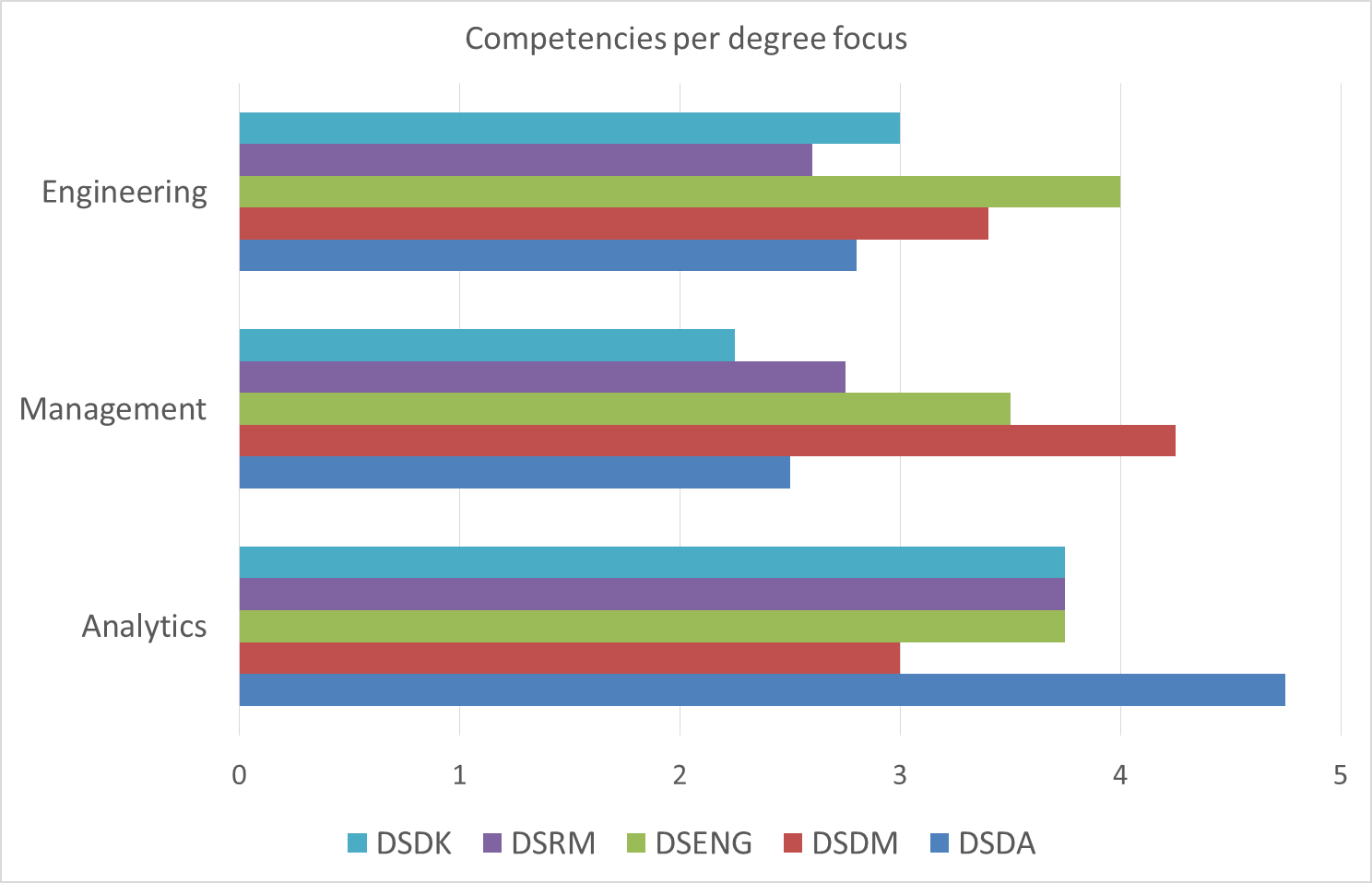
#### Master of Arts in Applied Data Science

Additional Case Study of Application of the EDSF on a newly developed Master Program Applied Data Science.The development is still ongoing.

**Mapping Competencies:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  | Master of Arts in Applied Data Science | | |
|  |  |  |  |  |  |  |  |  |  |
| **Managers** | DSDA | DSDM | DSENG | DSRM | DSDK |  | Analytics | Management | Engineering |
| DSP01 Data Science (group) Manager | 3 | 4 | 3 | 3 | 2 |  |  | x |  |
| DSP02 Data Science Infrastructure Manager | 2 | 4 | 4 | 2 | 2 |  |  | x |  |
| DSP03 Research Infrastructure Manager | 2 | 4 | 4 | 3 | 2 |  |  | x |  |
| **Professionals** |  |  |  |  |  |  |  |  |  |
| DSP04 Data Scientist | 5 | 3 | 4 | 5 | 3 |  | x |  |  |
| DSP05 Data Science Researcher | 4 | 3 | 2 | 5 | 4 |  |  |  |  |
| DSP06 Data Science Architect | 4 | 3 | 5 | 3 | 3 |  | x |  | x |
| DSP07 Data Science (Application) Programmer/Engineer | 4 | 2 | 5 | 3 | 3 |  |  |  | x |
| DSP08 Data Analyst | 5 | 3 | 3 | 3 | 4 |  | x |  |  |
| DSP09 Business Analyst | 5 | 3 | 3 | 4 | 5 |  | x |  |  |
| **Professional (data handling/ management)** |  |  |  |  |  |  |  |  |  |
| DSP10 Data Stewards | 3 | 5 | 3 | 3 | 3 |  |  | x |  |
| DSP11 Digital data curator | 1 | 5 | 2 | 2 | 3 |  |  |  |  |
| DSP12 Digital Librarians | 2 | 5 | 2 | 2 | 3 |  |  |  |  |
| DSP13 Data Archivists | 1 | 5 | 1 | 1 | 3 |  |  |  |  |
| **Professional (database)** |  |  |  |  |  |  |  |  |  |
| DSP14 Large scale (cloud) database designer | 2 | 4 | 4 | 3 | 3 |  |  |  | x |
| DSP15 Large scale (cloud) database administrator | 2 | 4 | 3 | 2 | 3 |  |  |  | x |
| DSP16 Scientific database administrator | 2 | 4 | 3 | 2 | 3 |  |  |  | x |
| **Technicians and associate professionals** |  |  |  |  |  |  |  |  |  |
| DSP17 Big Data facilities Operator | 1 | 4 | 3 | 2 | 3 |  |  |  |  |
| DSP18 Large scale (cloud) data storage operator | 1 | 4 | 3 | 1 | 1 |  |  |  |  |
| DSP19 scientific database operator | 1 | 4 | 3 | 2 | 3 |  |  |  |  |
| **Clerical support workers (general and keyboard workers)** |  |  |  |  |  |  |  |  |  |
| DSP20 data entry/access workers | 2 | 1 | 0 | 0 | 2 |  |  |  |  |
| DSP21 data entry field workers | 2 | 1 | 0 | 0 | 2 |  |  |  |  |
| DSP22 User support data services | 3 | 2 | 0 | 0 | 2 |  |  |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | DSDA | DSDM | DSENG | DSRM | DSDK |  |
| Analytics | 4,75 | 3 | 3,75 | 3,75 | 3,75 | 0 |
| Management | 2,5 | 4,25 | 3,5 | 2,75 | 2,25 |  |
| Engineering | 2,8 | 3,4 | 4 | 2,6 | 3 |  |



Data Science Analytics (DSDA), Data Management (DSDM), Data Science Engineering (DSENG), Scientific/ Research Methods (DSRM), DS Domain Knowledge, e.g., Business Apps (DSDK)

**Mapping Knowledge Units:**

|  |  |  |  |
| --- | --- | --- | --- |
| **CG / KAG** | **Target competence** | **Title** | **Knowledge areas (possible modules)** |
| KAG1-DSDA | DSDA01 | Predictive Analytics | Data mining Text Analytics Information Retrieval |
| KAG1-DSDA | DSDA02 | Statistics | Statistical Methods Data Query & Manipulation Languages |
|  | DSDA04 | Complex Data Analysis | Big Data Analytics Artificial Intelligence Machine Learning Natural Language Processing |
| |  | | --- | | KAG1-DSDA | | DSDA06 | Visualization | Data Visualization Data Communication |
| KAG2-DSENG | DSENG01 | Engineering Principles | Data Engineering |
| KAG2-DSENG | DSENG02 | Computational Thinking | Computational Thinking for Data Analytics |
| KAG2-DSENG | DSENG03 | DSS Development | Decision Support Systems Business Intelligence Management Support Systems Enterprise Information Systems Search Engine Technology |
| KAG2-DSENG | DSENG04 | DBMS | Relational Databases NoSQL Databases Large Scale data systems |
| KAG2-DSENG | DSENG05 | Data Security | Data security management Data Protection |
| KAG2-DSENG | DSENG06 | DS Application Prototyping | Programmig Languages for Data Analytics Cloud Computing architecture and services |
| KAG3-DSDM | DSDM01 | Data Strategy & Planning | Reference and Master Data Management |
| KAG3-DSDM | DSDM02 | Data Modelling | Data Models |
| KAG3-DSDM | DSDM03 | Data Integration / ETL | Enterprise Application Integration Metadata management |
| KAG3-DSDM | DSDM04 | Data Historization | Data Warehousing |
| KAG3-DSDM | DSDM05 | Data Quality | Data Quality Management |
| KAG3-DSDM | DSDM06 | Legal / ethical | Data privacy Ethics of Data Science |
| KAG4-DSRM | DSRM01 | Scientific Method | Scientific Method for Data Analysis |
| KAG4-DSRM | DSRM01 | Design Thinking | Design Thinking for Data Analytics |
| KAG5-DSRM | DSDK02 | Data based Innovation | Data based Innovation |
| KAG5-DSRM | DSDK05 | Analytic CRM | Analytic CRM |
| KAG5-DSRM | DSDK06 | Marketing Analytics | Marketing Analytics |

**Mapping Learning Outcomes:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Target competences** | **Title** | **Prio** | **Expertise** |
| DSDA01 | Predictive Analytics | 1 | Assessment |
| DSDA02 | Statistics | 1 | Useage |
| DSDA04 | Complex Data Analysis | 2 | Familiarity |
| DSDA06 | Visualization | 1 | Useage |
| DSENG01 | Engineering Principles | 2 | Familiarity |
| DSENG02 | Computational Thinking | 1 | Useage |
| DSENG03 | DSS Development | 2 | Familiarity |
| DSENG04 | DBMS | 1 | Assessment |
| DSENG05 | Data Security | 2 | Familiarity |
| DSENG06 | DS Application Prototyping | 1 | Useage |
| DSDM01 | Data Strategy & Planning | 2 | Familiarity |
| DSDM02 | Data Modelling | 1 | Useage |
| DSDM03 | Data Integration / ETL | 1 | Useage |
| DSDM04 | Data Historization | 2 | Familiarity |
| DSDM05 | Data Quality | 2 | Familiarity |
| DSDM06 | Legal / ethical | 2 | Familiarity |
| DSRM01 | Scientific Method | 1 | Useage |
| DSRM01 | Design Thinking | 1 | Useage |
| DSDK02 | Data based Innovation | 1 | Useage |
| DSDK05 | Analytic CRM | 1 | Assessment |
| DSDK06 | Marketing Analytics | 2 | Familiarity |

# The School of Data Science

Persontyle launched their School of Data Science in 2014. The goal is to produce data science training and education for professionals. What is offered:

* Data Science/Machine Learning Courses
* Hadoop Training
* On-site Corporate Training
* 6 week Bootcamp for PhD graduates
* Fellows program for using data science for social good

The offerings are available for a reasonable fee and they are taught in cities around the globe. The training is individualized and can be adjusted to the special needs of the participants. Plus, it is targeted at businesses and working professionals.

Currently Persontyle is restructuring their offerings. The EDSF guidelines will help to especially match the professional profiles of future Data Scientists with the line-up of Persontyle.

The overview of DSPP is very useful as guideline.

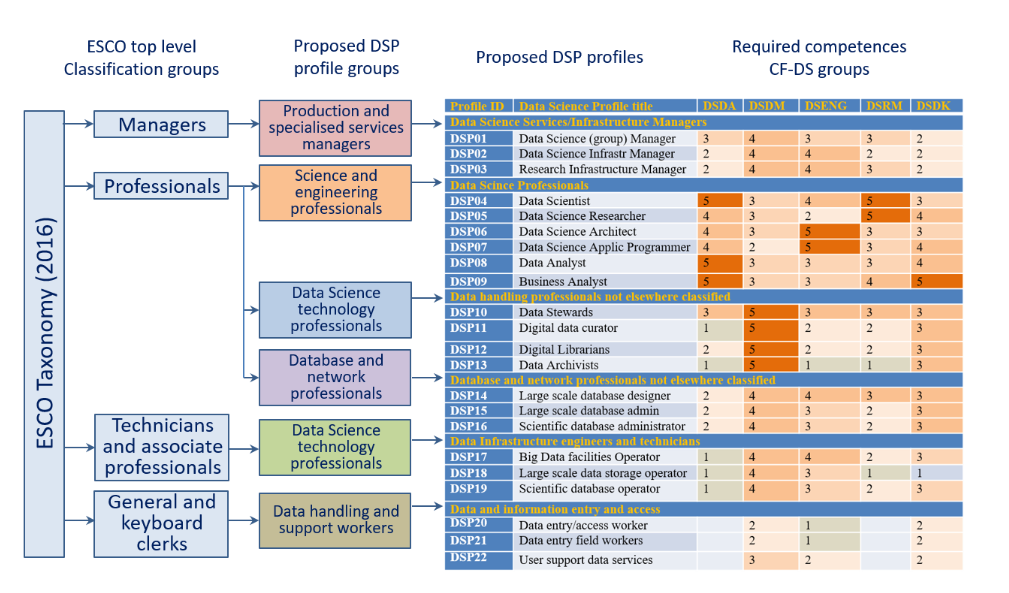


Figure 1: DSPP by classification groups

In addition the developments on team composition are great to get a new view on possible team compilations and extended fields of working for Data Scientists.

The current focus of training and education courses of The School of Data Science is primary covering Data Science and Machine Learning, so the DSENG part. The Data Management related profiles and competences would be a very interesting supplementing and will be discussed for the new offerings in 2018.