CASE Studies:

How to use and validate algorithms in recruitment
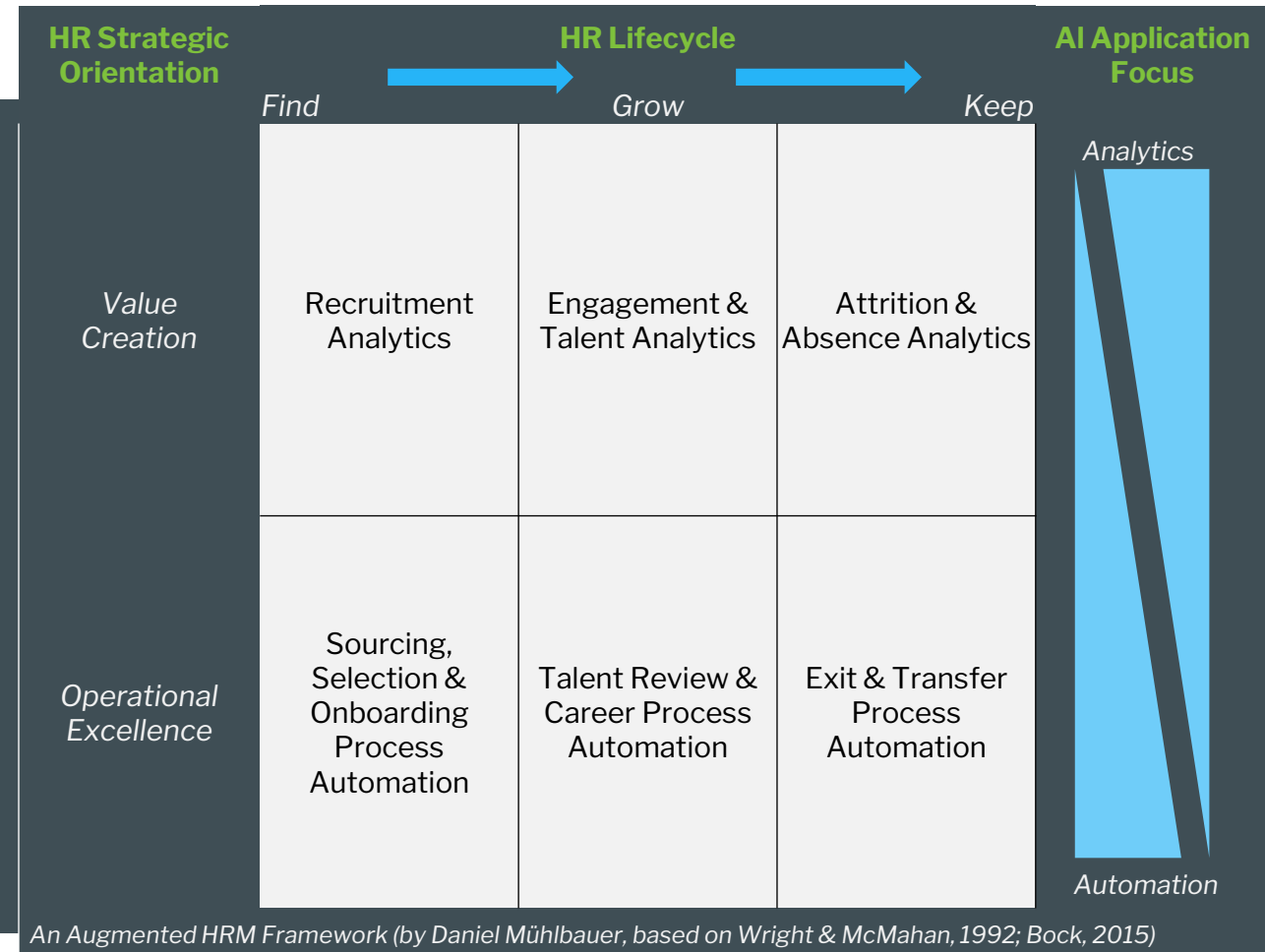
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How to use and validate algorithms in recruitment

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What type of algorithms are there in hiring?

Algorithms play a role in all stages of the HR lifecycle - from being recruited to leaving the company. At different stages in an employee's career span, algorithms can help to overcome different challenges. One important differentiation is between algorithms that support the automation of processes and algorithms that enable analytics. With regard to recruitment, algorithms that automate processes could be involved in better applicant tracking or assist with scheduling interviews. Theses algorithms are usually less risky as they are not involved with the actual decision to reject or accept candidates. Therefore, this whitepaper will focus mainly on how algorithms can help to identify the right applicants to hire and what types of mistakes should be avoided.

HR Strategic Orientation	HR Lifecycle			AI Application Focus
	Find	*Grow*	*Keep*	*Analytics*
Value Creation	Recruitment Analytics	Engagement & Talent Analytics	Attrition & Absence Analytics	
Operational Excellence	Sourcing, Selection & Onboarding Process Automation	Talent Review & Career Process Automation	Exit & Transfer Process Automation	*Automation*

An Augmented HRM Framework (by Daniel Mühlbauer, based on Wright & McMahan, 1992; Bock, 2015)

What type of algorithms are there in hiring?

While not yet widely applied on a company level, many algorithms support recruitment already today.

- Sourcing algorithms search the web automatically for suited candidates. They scan professional networks or other databases. Similarly, professional networks use algorithms to optimise who sees their job ads.

- Filtering algorithms use clearly defined criteria (e.g. having obtained a drivers license) to identify fitting applicants and to reject others.

- Matching / contextualisation algorithms help with the assessment of CVs. Candidates are "matched" or "ranked" based on their skills with potential companies. Some companies also offer to automatically analyse how a motivation letter was written up.

- Finally, workforce planning algorithms are trying to predict the future and the success of employees and inform about how many open positions will need to be filled within a certain amount of time.

In general, algorithms can be adapted to the specific needs of a company and are therefore very flexible. Studies by the National Bureau of Economic Research say, recruitment with the help of algorithms lead to higher quality hires for businesses.

Although the potential of AI and digitisation in HR is recognized across the board, HR departments find it difficult to implement such a projects:

(1) One reason for this is that the deeper technical understanding of AI solutions, and thus the knowledge of what possibilities would be available for integration, is often lacking or scarce among HR experts. For example, although employees are experts in human resources, they are usually not trained in machine learning or other big data technologies.

(2) Even more important, it is often unclear, how an algorithm impacts personnel selection. While algorithms provide great potential to improve hiring, they might also do harm. HR needs to require the providers of algorithms to produce evidence, that their algorithms are actually helping to make non-discriminatory and prognostically valid decisions. The final section outlines what needs to be done to see if algorithms are actually improving hiring.

Can algorithms help to assess CVs?

CVs are widely used in hiring, and often misused. In many cases simple rules of thumb are used to assess different information like education or job experience. Unfortunately, CVs only become very powerful tools for applicant selection once the information on it is analysed relative to its respective context.

An example: Absolute grades say very little about the actual performance in education. This is because there are large differences in grading standards and all institutions greatly differ in class composition, both as a result of the self-

selection of students and of formal selection criteria. A degree is only a meaningful indicator to be used in hiring decisions if this context is taken into account.

CASE is offering such context data to screen CVs with regard to performance in education. For this we require no personalised information, but only the subject, degree, graduation year and university. The following page displays how our algorithm puts educational achievement into context, which data is required to do so and how an assessment is created.

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Bildung

Bonn, Deutschland	Universität Bonn – Bonn Graduate School of Economics
September 2013 – August 2015	M.Sc.: Economics, Notendurchschnitt: 1,4
	These: Gender-Wage-Gaps im internationalen Vergleich

Maastricht, Niederlande	Maastricht University – School of Business and Economics
September 2010 – August 2013	B.Sc.: International Business, Notendurchschnitt: 8.4
	Major: Business Strategy

Köln, Deutschland	Gymnasium Erzbischöfliche Liebfrauenschule Köln
September 2001 – August 2010	Abitur, Notendurchschnitt: 2,0
	Leistungskurse: Geschichte und Mathe

Arbeitserfahrung

| Bonn, Deutschland | candidate select GmbH (CASE) Data Scientist |
| Seit April 2016 | Algorithmische Bewertung von akademischen Abschlüssen |

| Bonn, Deutschland | Universität Bonn (GSBE) Wissenschaftliche Mitarbeiterin |
| Januar 2015 – März 2016 | Arbeitsmarktforschung mit Blick auf Diskriminierung |

| Köln, Deutschland | Studitemps GmbH Intern |
| August 2012 – Oktober 2015 | Recruiting von Studenten und Marketing |

Soziale Aktivitäten

| Maastricht, Niederlande | Scope (Studentenvertretung) Präsident |
| Januar 2011 – Januar 2012 | Organisation von Tutorials zur Klausurvorbereitung und Besuchen bei Unternehmen |

| Köln, Deutschland | Sozialdemokratische Partei Deutschland Aktives Mitglied |
| Seit Oktober 2008 | Unterstützung bei Wahlkämpfen und Organisation von Veranstaltungen |

Sprachkenntnisse

Deutsch (Muttersprache), Englisch (Verhandlungssicher), Spanisch (Fortgeschritten), Niederländisch (Basis-Kenntnisse)

IT – Kenntnisse

Microsoft Office (Excel, Outlook, Power Point, Word), LaTex; Adobe Creative Suite (Photoshop, Illustrator, After Effects); Stata, Eviews, Matlab, R; HTML, JavaScript, Python

Can algorithms help to assess CVs?

Grade Distributions

Why: A grade reveals strong performance only if it is put into context with other graduates

How: Administrative grade data, in most cases retrieved from the universities themselves

Programme Rankings

Why: Relatively tougher competition from classmates makes it harder to earn a high grade

How: IQ and personality tests, admission exams and labour market outcomes

CASE Algorithm (optimises the weighting):
"Is it possible for someone from a less competitive university to overtake someone from a top institution?"

CASE Score

How to combine algorithms and other hiring criteria?

Algorithms can be combined with other hiring criteria. The rules on how to combine different criteria – irrespective of whether an algorithm is being used – should always be formulated before the actual selection of candidates begins and optimised thereafter using data. In many cases hiring improves greatly if different types of information are combined in such a clearly defined way.

To demonstrate how this could be done we present data from a CASE study that we conducted together with Deutsche Post DHL Group. The dataset consists of 287 candidates, the majority of which was not considered after failing to reach a minimum score in a online test. Still, more than a hundred applicants proceeded to the phone interview stage and 38 were invited to an assessment centre at the DHL Tower in Bonn. The applicant process is shown in the graph on the right.

The CASE Score itself was not used as a formal criterion within the hiring process, as this has been one of the first applications with the purpose of validation. On the next page we show how the process could have benefited greatly if this information had been used.

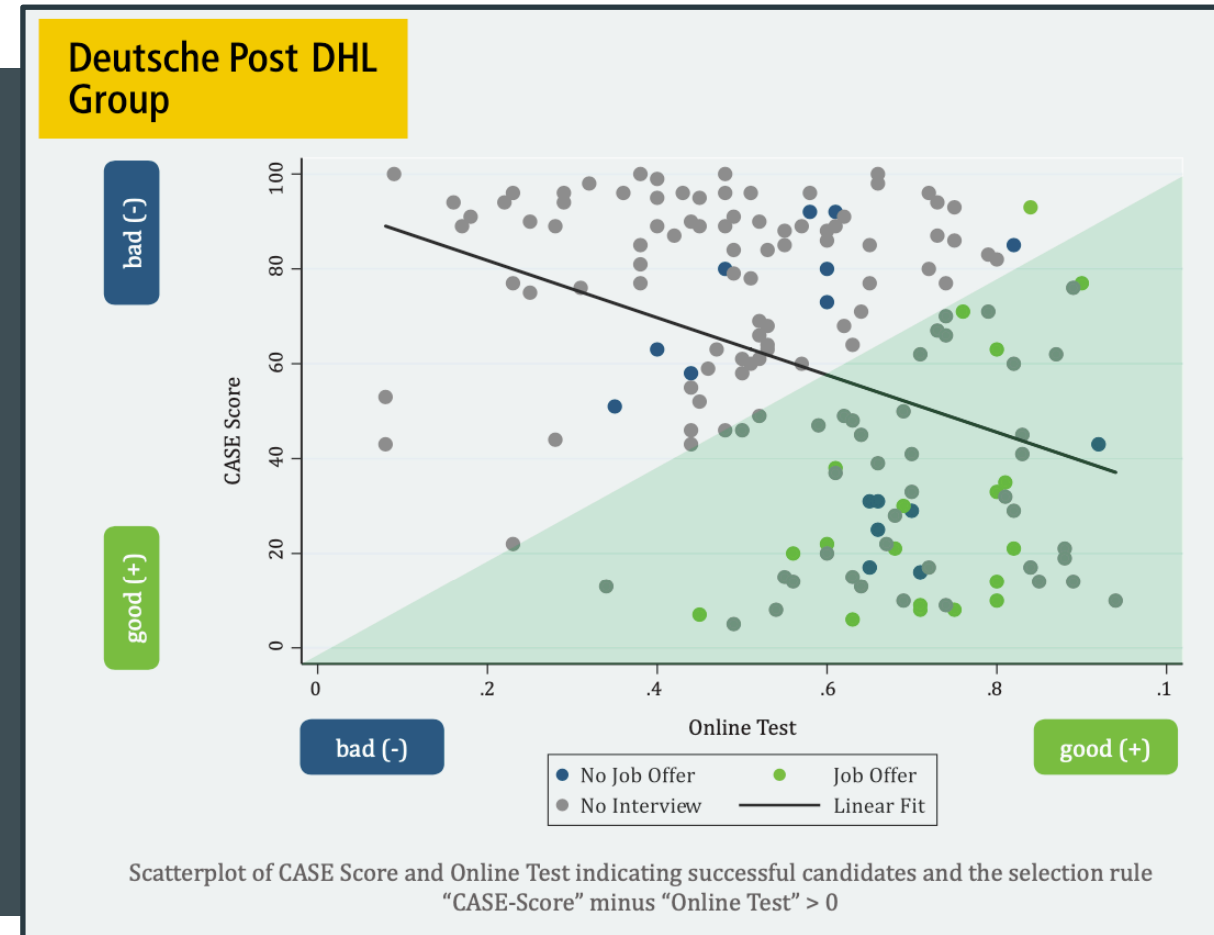Hiring process of the JOIN programme at DP-DHL
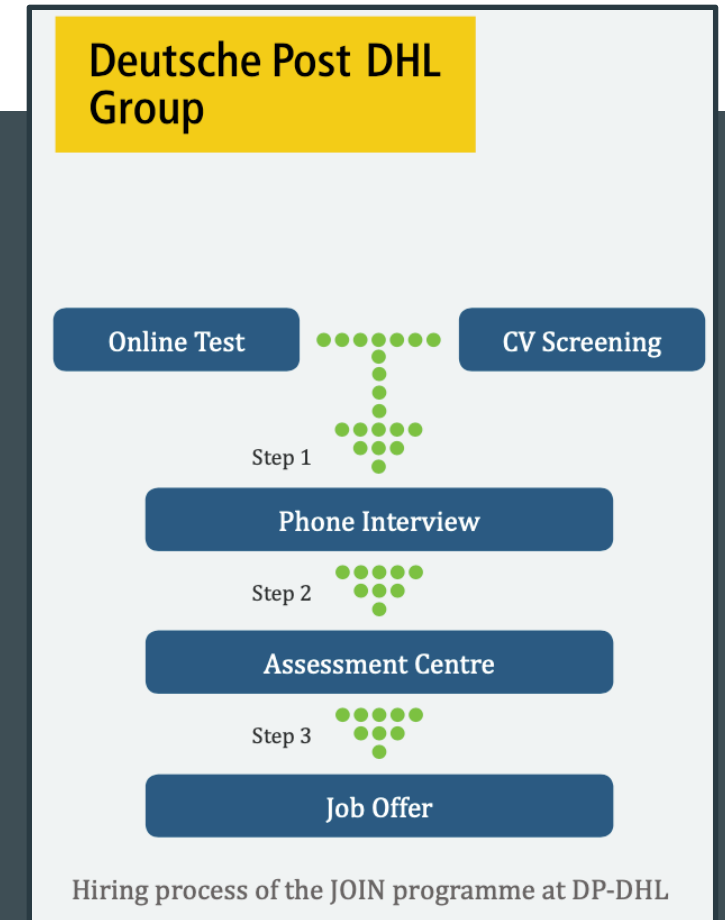
How to combine algorithms and other hiring criteria?

The plot shows all candidates as dots in different colours. Grey dots depict candidates who were excluded before the assessment centre, blue dots those who were excluded after the assessment centre and green dots those who received a job offer after the assessment centre.

The green triangle divides the plot in two equal halves. Candidates inside it belong to the better 50% of candidates in terms of a simple linear combination of the CASE Score and the online test that has been used by Deutsche Post DHL Group.

Combining these two information, it is possible to make highly predictive decisions early in the selection-process: In this example recruitment costs could have been cut by 80%, while simultaneously missing fewer good candidates and lowering the rate of unsuccessful assessment centre participations.

Scatterplot of CASE Score and Online Test indicating successful candidates and the selection rule "CASE-Score" minus "Online Test" > 0

How to decide if an algorithm is improving hiring?

To determine whether an algorithm (or any other recruitment instrument) is improving hiring, two factors should be of central importance:

(1) Predictive validity: Do candidates who are scored well by the algorithm perform better once hired (e.g. better reviews, faster promotions)

(2) Fairness: Does the algorithm give better scores to certain groups (e.g. by gender or ethnicity)

Any HR department should make sure to answers these two questions repeatedly based on data – not based on individual candidates or subjective opinions. A simple validation can be done by calculation correlations in Excel without the need of advanced software. More detailed answers can be obtained from a more structured study-design and data-analysis. Many companies have been setting-up people analytics capacities in-house that can support recruiters by such a project. Moreover, we at CASE are happy to help with such a project as well and have developed advanced metrics like the FAIR Index to quantify fairness within recruitment.

Regarding the CASE Score to analyse academic achievement we have answers both questions repeatedly.
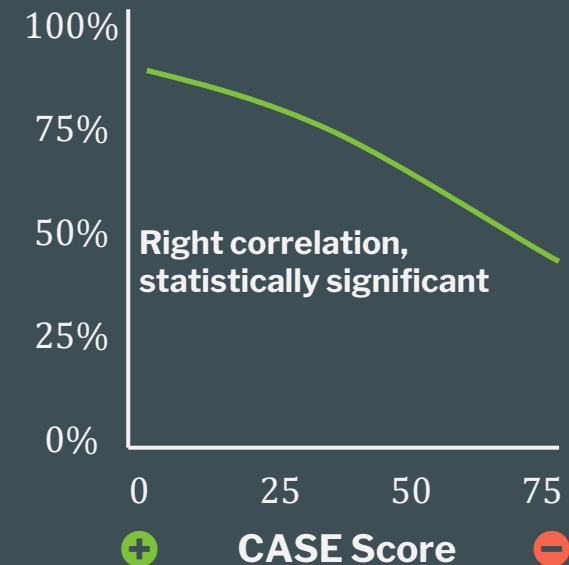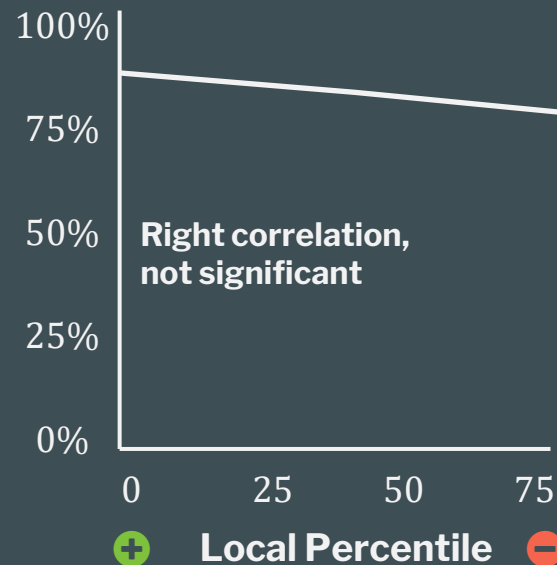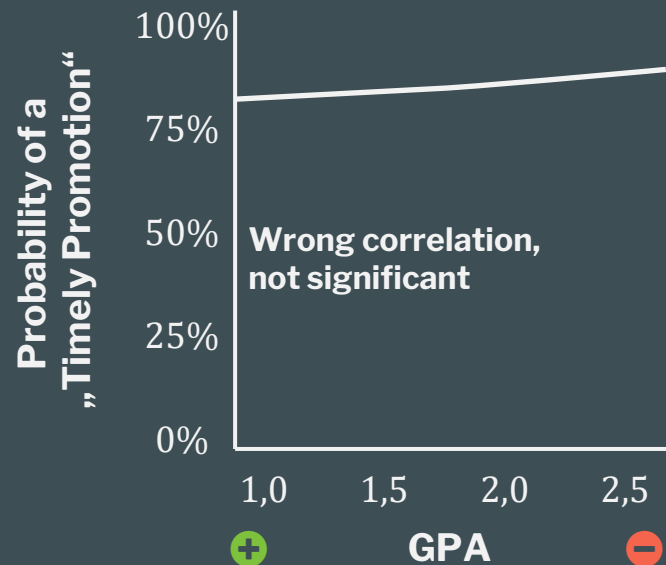
(1) An example of the good predictive validity of the CASE Score is shown on the next slide. In a study together with Simon-Kucher & Partners, a consultancy, we have demonstrated that the CASE Score allows to form very good predictions of whether or not consultants will be promoted in time. We can show that while absolute grades (GPAs) do not allow to make such forecasts, candidates with a good CASE Score are promoted "on time" in 90% of the cases, compared to 50% for candidates with weak scores. These findings have been replicated in other studies

(2) Regarding the fairness implications of the CASE Score we can show – based on a sample of more than 30,000 students – that there are no fundamental differences in gender. Without any corrections females slightly outperform males (4 percentiles out of 100). This is, however, not the result of the algorithm itself, but due to the fact that woman, ceteris paribus, achieve higher grades in education.

How to decide if an algorithm is improving hiring?

CASE Study with

SIMON ◆ KUCHER & PARTNERS
Strategy & Marketing Consultants

Timely promotion of consultants

Probability of a „Timely Promotion"

Wrong correlation, not significant

➕ **GPA** ➖

Right correlation, not significant

➕ **Local Percentile** ➖

Right correlation, statistically significant

➕ **CASE Score** ➖

Many companies trust us to design algorithms for their pre-selection

Media & Blogs

DER SPIEGEL

Wirtschafts Woche

Handelsblatt

DER TAGESSPIEGEL

General-Anzeiger

Kölner Stadt-Anzeiger

Frankfurter Allgemeine Personaljournal

Personalwirtschaft

personal. magazin

HRperformance

SAATKORN

Customers & Partners

BCG

SIMON • KUCHER & PARTNERS
Strategy & Marketing Consultants

KEARNEY

T···

AIRBUS

Studitemps

SIEMENS

EVONIK
POWER TO CREATE

Deutsche Post DHL

innogy

PORSCHE

MAHLE

viega

XING

Research & Funding

FAIR
Artificial Intelligence Recruiting

UNIVERSITÄT BONN

Maastricht University

Universität zu Köln

EUROPÄISCHE UNION
Investition in unsere Zukunft
Europäischer Fonds
für regionale Entwicklung

Ministerium für Wirtschaft, Innovation,
Digitalisierung und Energie
des Landes Nordrhein-Westfalen

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