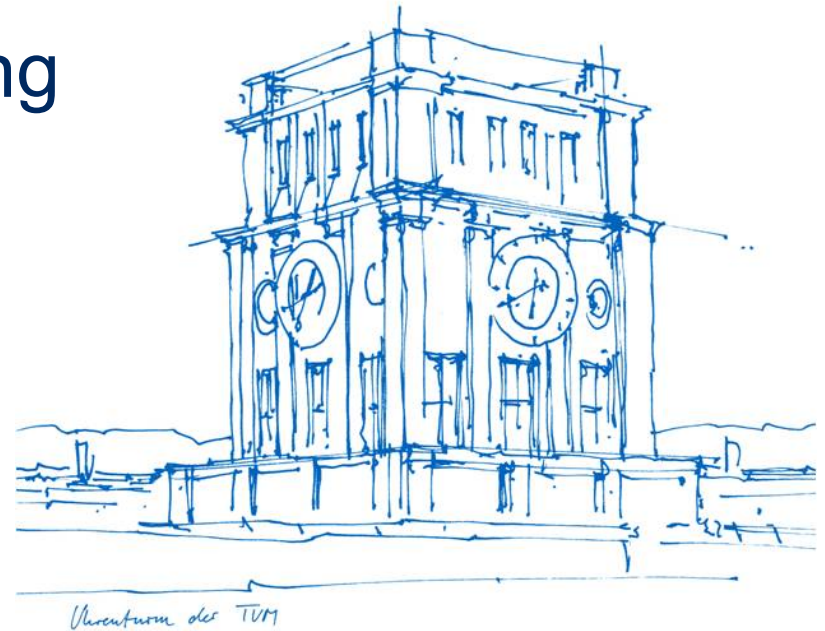


Exercises for Social Gaming and Social Computing (IN2241 + IN0040)

Exercise Sheet 3

Topic: Collaborative Filtering



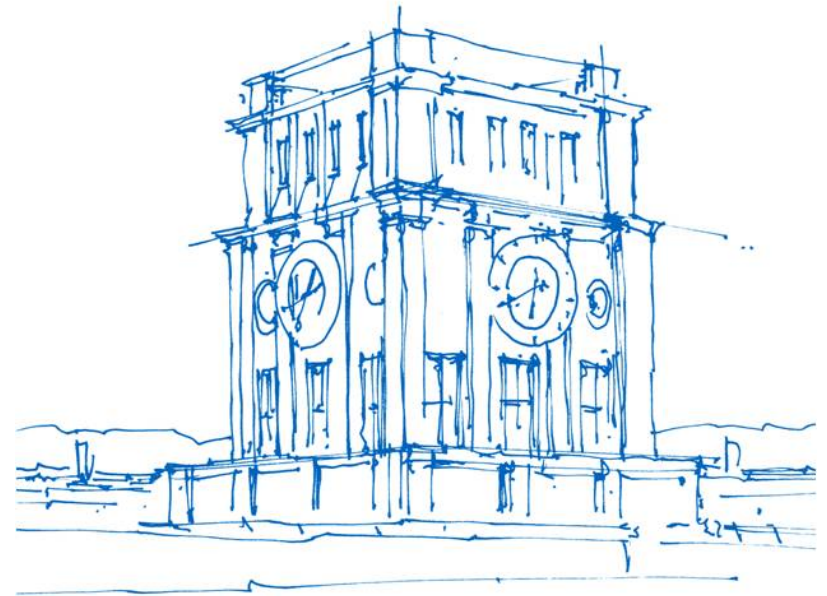
Exercise Content

Sheet Number	Exercise	Data Gathering	Deadline
0 (prep)		<ul style="list-style-type: none">• Install software (python and libraries) following instructions• Install mobile data app• Register on our platform	
1	<ul style="list-style-type: none">• Introduction to Python: basic Python programming language exercises• Graph Drawing using igraph	<ul style="list-style-type: none">• mobile data gathering (nothing actively to do)• social context in group rec experiment: complete questionnaires, form groups, rate restaurants etc.	<ul style="list-style-type: none">• Sunday, May 27, 24:00
2	<ul style="list-style-type: none">• Centrality measures	<ul style="list-style-type: none">• mobile data gathering (nothing actively to do)• social context in group rec experiment: complete questionnaires, form groups, rate restaurants etc.	<ul style="list-style-type: none">• Sunday, June 3, 24:00
3	<ul style="list-style-type: none">• Recommender Systems as an example for systems using simple forms of social context: Collaborative Filtering	<ul style="list-style-type: none">• mobile data gathering (nothing actively to do)• social context in group rec experiment: complete questionnaires, form groups, rate restaurants etc.	<ul style="list-style-type: none">• Sunday, June 10, 24:00

Exercise Content

Sheet Number	Exercise	Data Gathering	Deadline
4	<ul style="list-style-type: none"> Clustering: <ul style="list-style-type: none"> metric: K-means Clustering networks: Girvan-Newman-Algorithm 	<ul style="list-style-type: none"> mobile data gathering (nothing actively to do) social context in group rec experiment: complete questionnaires, form groups, rate restaurants etc. 	<ul style="list-style-type: none"> Sunday, June 17, 24:00
5	<ul style="list-style-type: none"> Group Recommender Systems Social Context in Group Recommender Systems 	<ul style="list-style-type: none"> mobile data gathering (nothing actively to do) 	<ul style="list-style-type: none"> Sunday, June 24, 24:00
6	<ul style="list-style-type: none"> Analysis of mobile Data: Paper: N. Eagle and A. Pentland: "Reality mining: sensing complex social systems". Pers. Ubiqu. Comp. 10, 4 (2006): <ul style="list-style-type: none"> Compute behavioral entropies Compare mobile network with long-term network 		<ul style="list-style-type: none"> Sunday, July 1, 24:00
7 (essay)	<ul style="list-style-type: none"> Essay (only if not participated in data gathering) : <ul style="list-style-type: none"> style of scientific paper / seminar paper (no personal opinions etc.) >= 2500 words (excluding citations) topic: Privacy in Social Media 		<ul style="list-style-type: none"> Sunday, July 16, 24:00

Data Collection Part I and II: Reminder



Uhrenturm der TUM

Data Collection: Part I: Social Context in Group Recommender Systems (data for sheet 5)

deadline:
Sunday, June 17

detailed steps and todos: see “exercise0” presentation

- **step 1:** register at <https://vmschlichter24.informatik.tu-muenchen.de> . **important:** check the data collection consent declaration.
- **step 2:** do Thomas-Kilman Conflict Model test (same platform)
- **step 3:** individually review 5+ restaurants
- **step 4:** form a class-internal group (3+ members)
- **step 5:** each member of internal group: provide social context: rate other group members
- **step 6:** formally create internal group, elect group persona
- **step 7:** sit together, review 5+ restaurants (as a group (internal group))
- **step 8:** form a class-external group (3+ members). you are automatically the group persona for the external group
- **step 9:** each member of external group: do steps 1, 2 and 3
- **step 10:** each member of external group: provide social context: rate other group members
- **step 11:** formally create external group, elect group persona
- **step 12:** sit together, review 5+ restaurants (as a group (external group))

Data Collection: Part II: Mobile Data (data for sheet 6)

detailed steps and todos: see “exercise0” presentation

1. Install app at Android or iOS device
2. Enable permissions on mobile device (may technically also ask for access to your contacts, app will however NOT collect this data)
3. Scan QR code to participate at user study



4. Register at <https://vmschlichter24.informatik.tu-muenchen.de> . **important: check the data collection consent declaration.**
5. Enter generated Device ID during registration

Data Collection

- Personal data will be **anonymized** before any processing
- We gather:
 - **part I:**
 - **Personal Data:** Full name, matriculation number (if student) - Date of birth - country - email address - device ID (mobile data collection experiment) - Coordinates of the main place - Thomas-Kilmann conflict model test data
 - **Social network data:** Trust, Tie strength, relationship strength, personal similarity, social context similarity, level of sympathy, social hierarchy, domain expertise
 - **Individual Restaurant ratings**
 - **Group Restaurant ratings**
 - **part II:**
 - **Location via GPS, network**
 - **Bluetooth environment**
 - **Cell id localization**
 - **Association with Wi-Fi networks**
 - **Environment sensors**
 - **acceleration, air pressure, magnetic field, temperature**

Permission for Data Collection (Part I and II)

This is a voluntary consent to contribute your data to research and teaching activities of Safey Halim, Michael Haus, Leonardo Tonetto, Georg Groh, and Jörg Ott (all Faculty of Informatics, TU-München). With your permission, your data will be collected, processed, and used for the following purposes:

Purpose 1a: Research conducted in the scope of the PhD thesis work of Michael Haus and Leonardo Tonetto on a common volume of data, including, but not limited to, mobility modeling and predictability, and private proximity testing.

Purpose 1b: Research conducted in the scope of the PhD thesis work of Safey Halim on social context in group recommender systems.

Purpose 2: Provide anonymized versions of the data to the registered students in the voluntary exercises of the class IN0040 Social Gaming / IN2241 Social Computing (SS2018, TUM, Faculty of Informatics) to be analyzed in the exercise sheets 5 and 6.

We will collect data during the months May and June 2017 with the help of a mobile phone app. This app collects the following sensor data from your phone and transmits it when a Wi-Fi connection is available:

- GPS location
- Cell id localization
- Bluetooth environment
- Environment sensors: acceleration, air pressure, magnetic field, temperature

We will during the months May and June 2017 further collect

- Personal Data: Full name, matriculation number (if student) - Date of birth - country - email address - device ID (mobile data collection experiment) - Coordinates of the main place - Thomas-Kilmann conflict model test data
- Social network data: Trust, Tie strength, relationship strength, personal similarity, social context similarity, level of sympathy, social hierarchy, domain expertise
- Individual Restaurant ratings
- Group Restaurant ratings

from students within the class and selected persons outside the class which are chosen by students in the class.

Please note that, while we do not store any personal information, this data could bear enough information to make you identifiable.

The data will be stored until 30.12.2020. Your personal data will be collected, processed, and used in the context of the aforementioned objectives in accordance with the Bavarian Data Protection Act (BayDSG).

The collection, processing, and use of your data take place on a voluntary basis. You can revoke your consent at any time without any adverse consequences. Please send any notice of cancellation to:

Technische Universität München, Research Group Social Computing I11; Boltzmannstr.3; 85748 Garching, E-Mail: grohg@in.tum.de

In the event of cancellation, your data will be deleted upon receipt of your notice.

Task: Collaborative Filtering

- Task: **Complement the given code** for a simple **collaborative filtering** movie recommender algorithm (a standard social computing application).
- Dataset: **Movielens**: Predict the top twenty (yet unrated) movies for user 15!

[illegible]

u.data

File Path ▾: ~/Desktop/socialCompUGaming2...ceV2/exercise2/movielens/u.data

u.data

1	196	242	3	881250949
2	186	302	3	891717742
3	22	377	1	878887116
4	244	51	2	880606923
5	166	346	1	886397596
6	298	474	4	884182806
7	115	265	2	881171488
8	253	465	5	891628467
9	305	451	3	886324817
10	6	86	3	883603013
11	62	257	2	879372434
12	286	1014	5	879781125
13	200	222	5	876042340
14	210	40	3	891035994
15	224	29	3	888104457
16	303	785	3	879485318
17	122	387	5	879270459
18	194	274	2	879539794
19	291	1042	4	874834944
20	234	1184	2	892079237
21	119	392	4	886176814
22	167	486	4	892738452
23	299	144	4	877881320
24	291	118	2	874833878
25	308	1	4	887736532
26	95	546	2	879196566
27	38	95	5	892430094
28	102	768	2	883748450
29	63	277	4	875747401
30	160	234	5	876861185
31	50	246	3	877052329
32	301	98	4	882075827
33	225	193	4	879539727
34	290	88	4	880731963

Line 1 Col 1 | Text File | Unicode (UTF-8) | Unix (LF) | 1.979...

Task: Collaborative Filtering

$r =$

	items								
users	4	—	—	—	—	—	1	2	—
	—	—	—	5	—	—	1	—	—
	—	5	5	—	—	—	1	—	5
	—	9	—	—	9	—	—	—	—
	—	—	—	—	—	3	3	—	—
	—	8	5	—	6	—	—	—	5
	1	—	—	1	—	3	—	2	—
	—	—	—	—	—	—	0	—	—
	—	7	6	1	6	—	—	—	6
	—	—	—	1	—	—	9	4	—
	—	—	—	—	—	4	—	—	6

Task: Collaborative Filtering

$r =$

items									
4	—	—	—	—	—	1	2	—	
—	—	—	5	—	—	1	—	—	
—	5	5	—	?	—	1	—	5	user u
—	9	—	—	9	—	—	—	—	
—	—	—	—	—	3	3	—	—	
—	8	5	—	6	—	—	—	5	
1	—	—	1	—	3	—	2	—	
—	—	—	—	—	—	0	—	—	
—	7	6	1	6	—	—	—	6	
—	—	—	1	—	—	9	4	—	
—	—	—	—	—	4	—	—	6	
				item i					

users

Task: Collaborative Filtering

$r =$

	items								
users	4	—	—	—	—	—	1	2	—
	—	—	—	5	—	—	1	—	—
	—	5	5	—	?	—	1	—	5
	—	9	—	—	9	—	—	—	—
	—	—	—	—	—	3	3	—	—
	—	8	5	—	6	—	—	—	5
	1	—	—	1	—	3	—	2	—
	—	—	—	—	—	—	0	—	—
	—	7	6	1	6	—	—	—	6
	—	—	—	1	—	—	9	4	—
	—	—	—	—	—	4	—	—	6
					item i				

$\mathcal{N}_i(u)$: users that rated item i
and that are similar to user u , e.g.:

$$\mathcal{N}_i(u) = \{v^{(i)} | \text{sim}(u, v^{(i)}) > \alpha\}$$

where e.g.

$$\text{sim}(u, v^{(i)}) = w_{uv} = \cos(\mathbf{u}, \mathbf{v}^{(i)}) \sim \mathbf{u} * \mathbf{v}^{(i)}$$

or:

$$\text{sim}(u, v^{(i)}) = w_{uv} = \frac{1}{|\mathbf{u} - \mathbf{v}^{(i)}|}$$

Task: Collaborative Filtering

	items								
	4	—	—	—	—	—	1	2	—
	—	—	—	5	—	—	1	—	—
	—	5	5	—	?	—	1	—	5
	—	9	—	—	9	—	—	—	—

user u

now: **predicted rating** for
item i of user u

$$\hat{r}_{ui} = \bar{r}_u + \frac{\sum_{v \in \mathcal{N}_i(u)} w_{uv} (r_{vi} - \bar{r}_v)}{\sum_{v \in \mathcal{N}_i(u)} w_{uv}}$$

or (more simple):

$$\hat{r}_{ui} = \frac{\sum_{v \in \mathcal{N}_i(u)} w_{uv} r_{vi}}{\sum_{v \in \mathcal{N}_i(u)} w_{uv}}$$

$\mathcal{N}_i(u)$: users that rated item i
and that are similar to user u, e.g.:

$$\mathcal{N}_i(u) = \{v^{(i)} | \text{sim}(u, v^{(i)}) > \alpha\}$$

where e.g.

$$\text{sim}(u, v^{(i)}) = w_{uv} = \cos(\mathbf{u}, \mathbf{v}^{(i)}) \sim \mathbf{u} * \mathbf{v}^{(i)}$$

or:

$$\text{sim}(u, v^{(i)}) = w_{uv} = \frac{1}{|\mathbf{u} - \mathbf{v}^{(i)}|}$$

now: **predicted rating** for
item i of user u

$$\hat{r}_{ui} = \bar{r}_u + \frac{\sum_{v \in \mathcal{N}_i(u)} w_{uv} (r_{vi} - \bar{r}_v)}{\sum_{v \in \mathcal{N}_i(u)} |w_{uv}|}$$

$\mathcal{N}_i(u)$: users that rated item i
and that are similar to user u , e.g.:

$$\mathcal{N}_i(u) = \{v_i | \text{sim}(u, v_i) > \alpha\}$$

where e.g.

$$\text{sim}(u, v_i) = \cos(\mathbf{u}, \mathbf{v}_i) \sim \mathbf{u} * \mathbf{v}_i$$

or:

$$\text{sim}(u, v_i) = |\mathbf{u} - \mathbf{v}_i|$$

items

users

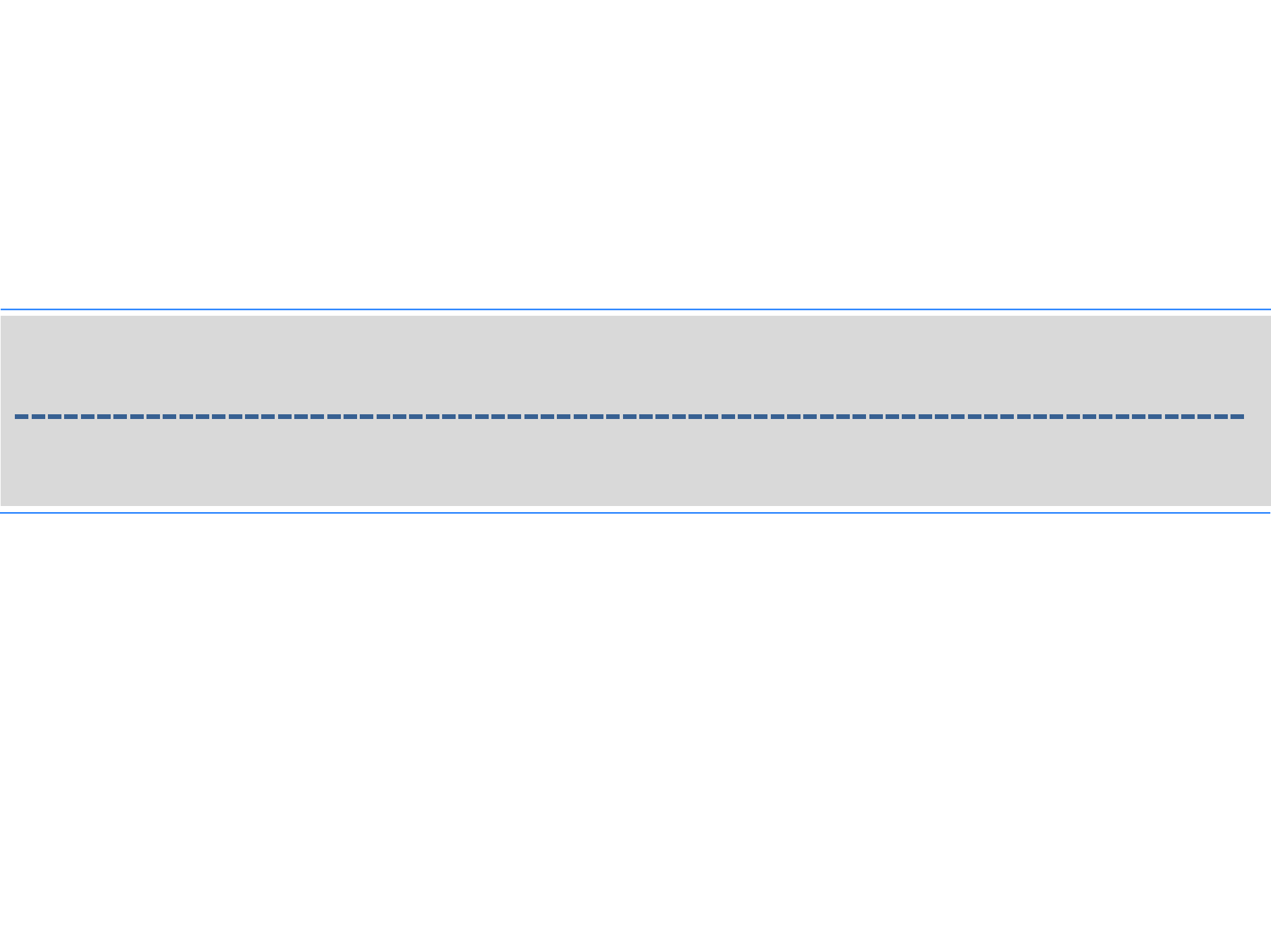
$r =$

4	—	—	—	—	—	1	2	—	
—	—	—	5	—	—	1	—	—	
—	5	5	—	?	—	1	—	5	user u
—	9	—	—	9	—	—	—	—	
—	—	—	—	—	3	3	—	—	
—	8	5	—	6	—	—	—	5	
1	—	—	1	—	3	—	2	—	$\mathcal{N}_i(u)$
—	—	—	—	—	—	0	—	—	
—	7	6	1	6	—	—	—	6	
—	—	—	1	—	—	9	4	—	
—	—	—	—	—	4	—	—	6	

item i

Exercise – Submission via Moodle

- Submit your finished .ipynb iPython notebooks **via Moodle**
- there is one Moodle course instance for IN0040 (Social Gaming) and another Moodle course instance for IN2241 (Social Computing)
- **Registration in Moodle \leftrightarrow register in TUM-Online** as a participant for IN0040 (Social Gaming) (Games Engineering students) or as a participant for IN2241 (Social Computing) (other students).
- **Deadline: Sunday, June 10, 24:00**



Citations

- (1) [Beazley 2013) David Beazley: Python Essential Reference, Safari Books 2013, E-Book available via www.ub.tum.de
- (2) [Rossant 2015] Learning IPython for Interactive Computing and Data Visualization (SECOND EDITION) by Cyrille Rossant, 175 pages Packt Publishing, October 2015
- (3) Nathan Eagle and Alex (Sandy) Pentland. 2006. Reality mining: sensing complex social systems. Personal Ubiquitous Comput. 10, 4 (March 2006)
- (4) Desrosiers, C., & Karypis: A Comprehensive Survey of Neighborhood-based Recommendation Methods, 2011 in: Ricci et al (eds.) "Recommender Systems Handbook", Springer 2011